Automation System 5400
Boiler Controller
TROVIS 5474

Mounting and Operating Instructions

EB 5474 EN

Firmware version 2.0x

Edition July 2004

TROVIS® Electronics from SAMSON

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We do not assume any liability for the accuracy or completeness of these mounting and operating instructions. Moreover, we do not guarantee that the buyer can use the product for an intended purpose. SAMSON rejects any liability for claims by the buyer, especially claims for compensation including lost profits or any other financial loss, except the damage was caused intentionally or by gross negligence. If an essential term of the contract is breached by negligence, SAMSON's liability is limited to the foreseeable damage.

Safety instructions

- The device may only be assembled, started up or operated by trained and experienced personnel familiar with the product. Proper shipping and appropriate storage are assumed.
- The controller has been designed for use in electrical power systems. For wiring and maintenance, you are required to observe the relevant safety regulations.
- The **Safety shutdown** function (section 8.10) does not replace the safety temperature limiter as the boiler controller is not a safety-relevant component.

Contents

1 Operation

The controller is ready for use with the temperatures and time schedules preset by the manufacturer.
On start-up, the **current time and date** need to be set at the controller (–> section 1.5).

1.1 Operating elements

The operating controls are located in the front panel of the controller and protected by a Plexiglas door.

1.1.1 Operating keys

Changeover key
(press using a pointed object such as a pen)
Switch from the info level to the parameter and configuration level and back

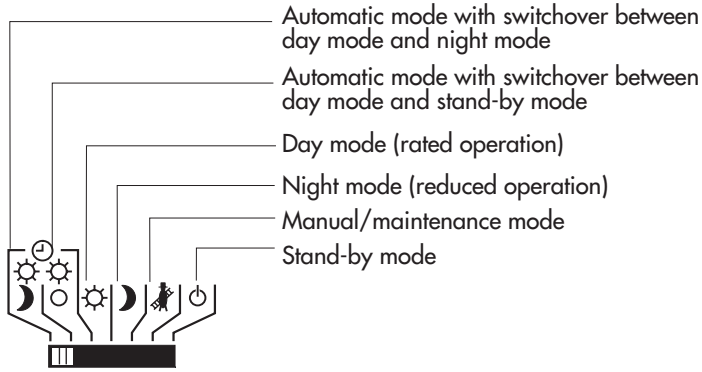
Reset key
(press using a pointed object such as a pen)
Press to reset accessible parameters to their default settings; the controller must be in the configuration level

Arrow keys
– To scroll within levels
– To change values

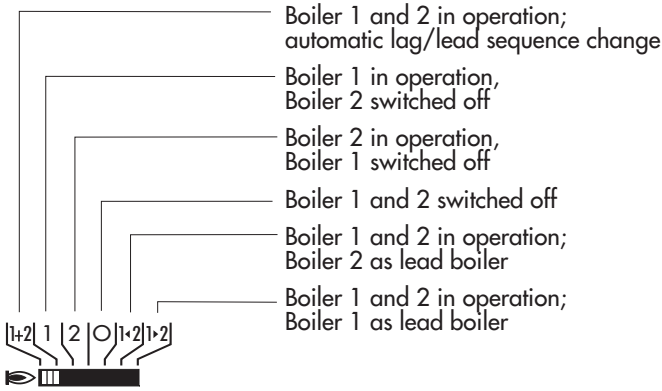
Enter key
– To access levels
– Access parameters and functions to edit them
– Confirm settings
– Display set points in the info level

1.1.2 Operating switches

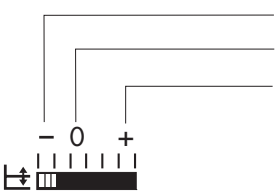
Mode selector switch



Selector switch



Correction switch for the flow temperature



Set point set-back by 2.5 °C per notch

No change in set point

Set point raised by 2.5 °C per notch

1.2 Operating modes

Day mode (rated operation) ☼

Regardless of the programmed times-of-use and summer mode, the set points relevant for rated operation are used by the controller.

Night mode (reduced operation) ☽

Regardless of the programmed times-of-use and summer mode, the set points relevant for reduced operation are used by the controller.

Stand-by mode ⏻

The controller is switched off. The boilers only work when there is a demand for DHW or a demand for an external set point. The protective functions remain active.

Automatic mode

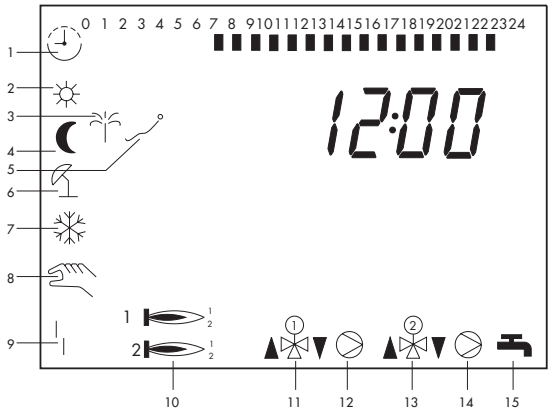
During the programmed times-of-use, the controller works in rated operation. Outside these times-of-use, the controller is in reduced operation or stand-by mode, depending on the settings. The controller switches automatically between both operating modes.

Maintenance mode

Pumps are controlled manually (–> section 3).
Control is not possible. Use the maintenance mode just for maintenance purposes and for emission measurements.
The default setting of the circulation pumps is set for constant operation.

1.3 Display

During operation, the display indicates the current time as well as information about the operation of the controller. The times-of-use are represented by black squares below the row of numbers at the top of the display. Icons indicate the operating status of the controller.



1 Automatic operation
2 Rated operation
3 Vacation mode
4 Reduced operation
5 Public holiday mode
6 Summer mode
7 Frost protection
8 Manual/maintenance mode
9 Malfunction
10 Boiler and boiler stages
11 Valve in control circuit 1
Open: Left arrow
Closed: Right arrow
12 Boiler pump 1 ON
13 Valve in control circuit 2
Open: Left arrow
Closed: Right arrow
14 Boiler pump 2 ON
15 DHW heating

Fig. 1 · Icons

The controller status can be displayed in the operating level (–> section 1.4).

1.4 Displaying data

Controller time, measured values, set points and limits, times-of-use, public holidays and vacation periods can be retrieved and displayed in the ***InF1*** to ***InF9*** info levels (-> Fig. 10 on page 131). The various levels are listed in section 13.3.

- InF1: Boiler 1
- InF2: System Anl 1 to 3, Co5 -> Fb13 = ON: Separate heating circuit
  System Anl 4 to 7: Boiler 2
- InF3: System Anl 1 to 3, Co5 -> Fb13 = ON: Direct heating circuit
- InF4: DHW heating
- InF5: General information, e.g. times-of-use
- InF8: Error initialization
- InF9: Modbus and meter bus communication

Proceed as follows:

⇩ Select info level.

✳ Open info level.

⇩ Scroll to read the various datapoints of the selected info level that appear one after the other.

✳ Compare the set point/limit with the actual value.

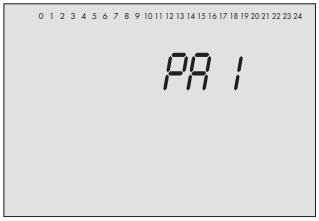
⇧ ⇩ Press both arrows keys simultaneously:
Return to the display with time.

1.5 Setting the controller time

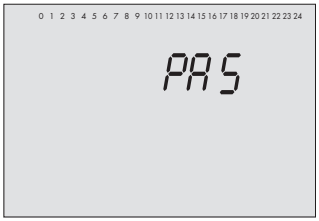
The current time and date need to be set immediately after start-up and after a power failure lasting longer than 24 hours. This is indicated by the time blinking on the display.

The time is set in the ***PA5*** parameter level.

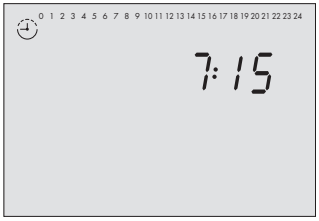
Proceed as follows:



Switch to the configuration and parameter level.
Display: ***PA1***



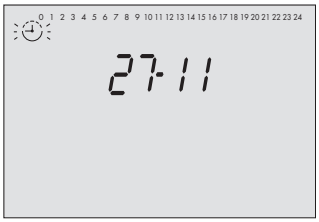
Select PA5 parameter level.



Open PA5 parameter level.
Display: Time

Activate editing mode for the controller time.
◴ blinks.

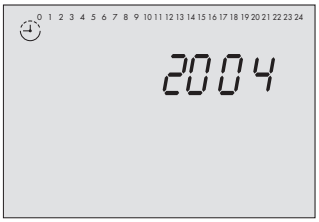
Change time.



Confirm time.
Display: Date (Day-Month)

Activate editing mode for the date.
◴ blinks.

Change date.



- Confirm date.
  Display: Year
- Activate editing mode for the controller time.
  ◴ blinks.
- Change year.
- Confirm year.
- Exit PA5 parameter level.
- Return to the operating level.

Note!

The controller automatically returns to the operating level if the keys are left unpressed for two minutes.

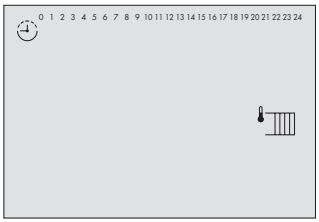
1.6 Setting the times-of-use

Two times-of-use can be set for each day of the week. If only one time-of-use is required, the start and stop times of the second time-of-use must be programmed to identical times.

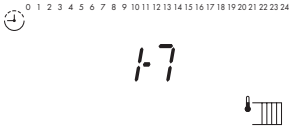
Parameters	WE	Parameter level / Range of values
Period/day	1–7	PA5 / 1–7, 1 to 7
Start first time-of-use	7:00	PA5 / 00:00 to 24:00h; in steps of 30 minutes
Stop first time-of-use	12:00	PA5 / 00:00 to 24:00h; in steps of 30 minutes
Start second time-of-use	12:00	PA5 / 00:00 to 24:00h; in steps of 30 minutes
Stop second time-of-use	22:00	PA5 / 00:00 to 24:00h; in steps of 30 minutes

Proceed as follows:

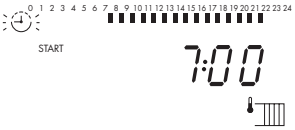
- Switch to the configuration and parameter level.
  Display: ***PA1***
- Select PA5 parameter level.
- Open PA5 parameter level.
  Display: Controller time



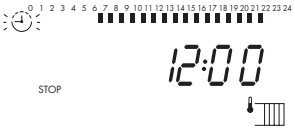
- Select datapoint for times-of-use.
  Display:



- Activate editing mode for times-of-use.
  Display: **1–7**
- Select period/day for which the times-of-use are to be valid:
  1–7 = Monday to Sunday,
  1 = Monday, 2 = Tuesday, …, 7 = Sunday



- Activate editing mode for period/day.
  Display: START; ◴ blinks.
- Edit start time (steps of 30 minutes).



- Confirm start time.
  Display: ***STOP***
- Edit stop time (steps of 30 minutes).
- Confirm stop time.
  Display: ***START***
  The second time-of-use is set like the first time-of-use.

To set the times-of-use for each day, repeat the instructions in the fields highlighted in gray.

- Select ***End*** on the display.
- Exit the datapoint for times-of-use.
- Exit the parameter level.
- Return to the operating level.

Note!
Do not use the 1–7 menu to check the programmed times-of-use. On opening this menu, the times-of-use are reset to their default settings.

Note!
The controller automatically returns to the operating level if the keys are left unpressed for two minutes.

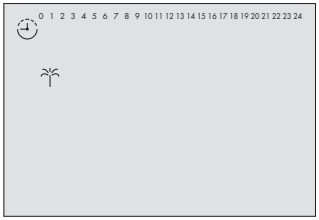
1.6.1 Entering vacation periods

When the switch position **Automatic operation with switchover between day mode and night mode** is selected, night set points (reduced set points) are used by the controller. When the switch position **Automatic operation with switchover between day mode and stand-by mode** is selected, the system is switched off. The frost protection function remains active.

A maximum of 10 vacation periods may be entered.

Parameter	WE	Parameter level / Range of value
Vacation periods	–	PA5 / 01.01 to 31.12

Proceed as follows:



- Switch to the parameter and configuration level. Display: ***PA1***
- Select PA5 parameter level.
- Open PA5 parameter level. Display: Controller time
- Select datapoint for vacation period. Display: ⚘
- Open data point for vacation period. Display: ***START***
- If applicable, select – – – –.
- Activate editing mode for vacation periods. ⚘ blinks.
- Set start date of vacation period.
- Confirm start date of the vacation period. Display: ***STOP***
- Set end of vacation period.
- Confirm end of the vacation period.

To enter additional vacations, re-select – – – – (between 31.12 and 01.01) and repeat the steps in the fields highlighted in gray.

- Exit the parameter level.
- Return to the operating level.

Note!

In systems Anl 1 to 3 with integrated DHW heating (Co5 -> Fb13 = ON), the vacations entered also apply to the DHW heating with the setting Co4 -> Fb10 = ON.

Vacation periods that are not assigned to a specific date should be deleted by the end of the year so that they are not carried on into the following year.

Deleting vacation periods:

- Select the vacation period you wish to delete in the datapoint for vacation periods.
- Confirm selection.
- Select – – – – .
- Delete vacation period.

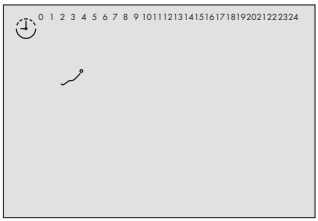
Note!
The controller automatically returns to the operating level if the keys are left unpressed for two minutes.

1.6.2 Entering public holidays

The times-of-use programmed for Sunday apply on public holidays. A maximum of 20 public holidays can be entered.

Parameter	WE	Parameter level / Range of value
Public holidays	–	PA5 / 01.01 to 31.12

Proceed as follows:



- Switch to the parameter and configuration level. Display: ***PA1***
- Select PA5 parameter level.
- Open PA5 parameter level. Display: Controller time
- Select datapoint for public holidays. Display: ⟋
- Open datapoint for public holidays. Display: ***START***
- If applicable, select – – – –.
- Activate editing mode for public holiday. ⟋ blinks.

  Edit public holiday.
- Confirm public holiday.

To enter additional public holidays, re-select – – – – (between 31.12 and 01.01) and repeat the steps in the fields highlighted in gray.

⇩ ⇧ Exit the parameter level.

⇨ Return to the operating level.

Note!
In systems Anl 1 to 3 with integrated DHW heating (Co5 -> Fb13 = ON), the public holidays entered also apply to the DHW heating with the setting Co4 -> Fb10 = ON.

Public holidays that are not assigned to a specific date should be deleted by the end of the year so that they are not carried on into the following year.

Deleting a public holiday:

⇩ Select the holiday you wish to delete in the datapoint for public holidays.

✳ Confirm selection.

⇩ Select – – – – .

✳ Delete the public holiday.

Note!
The controller automatically returns to the operating level if the keys are left unpressed for two minutes.

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2 Start-up

2.1 Setting the system code number and the boiler rating

7 different hydraulic schematics are available. Each system configuration is represented by a system code number (Anl). The different schematics are dealt with in section 4. Available controller functions are described in sections 5 to 8.

Changing the system code number resets previously adjusted function blocks to their default settings (WE). Function block parameters and settings in the parameter level remain unchanged.

The system code number is set in the parameter and configuration level.

Proceed as follows:

- Switch to the parameter and configuration level.
  Display shows: ***PA1***
- Select ***Anl*** level.
- Open ***Anl*** level.
  Display: ***Anl 1***
- Select system code number (Anl).

System Anl 1	***Anl 1***	Single boiler for one-stage burner
System Anl 2	***Anl 2***	Single boiler for two-stage burner
System Anl 3	***Anl 3***	Single boiler for modulating burner
System Anl 4	***Anl 4***	Double boiler for one-stage condensing boiler and two-stage low-temperature boiler
System Anl 5	***Anl 5***	Double boiler for 2 two-stage burners
System Anl 6	***Anl 6***	Double boiler for modulating and two-stage burner
System Anl 7	***Anl 7***	Double boiler for two modulating burners

- Confirm system code number (Anl).
  The burner and stage icons for burner 1 blink.
  The boiler rating is shown.

- Set the required rating.
  Set first the capacity of the basic stage and then the total capacity of the burner of two-stage and modulating burners.
- Confirm the rating.
  Set the capacity of the second burner in systems Anl 4 to 7.
- Select ***End*** on the display.
- Exit the ***Anl*** level.
  Display: ***Co1***

2.2 Activating and deactivating functions

A function is activated or deactivated in the associated function block. The numbers 0 to 24 in the top row of the display represent the respective function block numbers. When a configuration level is opened, the activated function blocks are indicated by a black square on the right-hand side below the function block number. The function blocks are described in section 13.2.

The functions are arranged in topic groups:

- Co1: Boiler 1
- Co2: Systems Anl 1 to 3, Co5 -> Fb13 = ON: separate heating circuit
  Systems Anl 4 to 7: Boiler 2
- Co3: Systems Anl 1 to 3, Co5 -> Fb13 = ON: direct heating circuit
- Co4: DHW heating
- Co5: General functions
- Co6: Sensor initialization
- Co8: Error initialization
- Co9: Modbus and meter bus communication

Proceed as follows:

- Switch to the parameter and configuration level.
  Display shows: ***PA1***
- Switch to the configuration level (-> Fig. 10, page 131).
- Open the configuration level.

↓ Select function block.

✳ Activate editing mode for function block.
The function block number starts to blink.
If ***0 0 0 0*** appears on the display, the key number needs to be entered first (refer to section 2.4).

↑ Activate function block (Fb = ON).
An activated function block is indicated by a black square below (right) the function block number in the top row of the controller display.

or:

↓ Deactivate function block (Fb = OFF).

✳ Confirm setting.
If the function block is not closed, further function block parameters can be adjusted.
Proceed as follows:
Make the desired changes and confirm.
If applicable, the next function block parameter is displayed.
Confirm all parameters to exit the opened function block.

To adjust additional function blocks within the configuration level, repeat the steps in the fields highlighted in gray.

✳ ↑ Exit the configuration level.

✳ Return to the operating level.

Note!
The controller automatically returns to the operating level if the keys are left unpressed for two minutes.

2.3 Changing parameters

Depending on the activated functions, not all parameters listed in the parameter list in the Appendix (–> section 13.2) might be available.

The parameters are arranged in topic groups:

- PA1: Boiler 1
- PA2: Systems Anl 1 to 3, Co5 -> Fb13 = ON: separate heating circuit
  Systems Anl 4 to 7: Boiler 2
- PA3: Systems Anl 1 to 3, Co5 -> Fb13 = ON: direct heating circuit
- PA4: DHW heating
- PA5: General parameters
- PA9: Modbus and meter bus communication

Proceed as follows:

Switch to the parameter and configuration level. Display: ***PA1***

Select parameter level (-> Fig. 10, page 131).

Open the parameter level.

Select parameter.

Activate editing mode for parameter.

Change parameter.

Confirm parameter setting.

To adjust additional parameters, repeat the steps in the fields highlighted in gray.

Exit the parameter level.

Return to the operating level.

Note!
The controller automatically returns to the operating level if the keys are left unpressed for two minutes.

2.4 Enter key number

Some functions are protected against unintentional or unauthorized access. These functions can only be activated or deactivated after the valid key number has been entered. The valid key number for initial start-up can be found on page 127. To avoid unauthorized use of the key number, remove the page or make the key number unreadable.

Proceed as follows:

0 0 0 0 blinks on the display.

⇩ Set valid key number.

✳ Confirm key number.
When the correct key number is entered, the function block to be changed blinks on the display.
When an incorrect key number is entered, the controller returns to the next configuration level.

The key number remains active for approx. 10 minutes.

2.5 Calibrating sensors

The connected sensors are calibrated in the Co6 configuration level. The following applies:

- Co6 -> Fb00 = ON: Pt 100/Pt 1000 sensors mixed (default setting)
- Co6 -> Fb00 = OFF: Pt 100/PTC sensors mixed

The resistance values of the sensors can be found on page 115.

Each universal input can be configured separately.
The function block parameter includes the following types: Ni 200/1000, PTC, NTC, Pt 100/1000, (0/4 to 20) mA. The function blocks Co6 -> Fb01 to Fb17 correspond to the binary inputs BE1 to BE17 in the terminal wiring plan (–> page 78 onwards).
Activate the function block for the required sensor and select the function block parameter which matches the type of the input signal.

Note!
Pt 100 or Pt 1000 sensor should be used to measure the flow temperature as only these types of sensor are able to measure temperatures reaching up to 160 °C (maximum temperature of the flow temperature set point).

If the temperature values displayed at the controller differ from the actual temperatures, the measured values of all connected sensors can be changed or readjusted. To calibrate a sensor, the currently displayed sensor value must be changed such that it matches the temperature (reference temperature) measured directly at the point of measurement.

Perform the calibration in function block Fb23 in Co6.

Proceed as follows:

- Switch to the parameter and configuration level.
  Display: ***PA1***
- Select Co6 configuration level.
- Open Co6 configuration level.
- Select function block Fb23.
- Confirm setting.
  Display: ***0 0 0 0***

  Enter currently valid key number.
  The function block Fb23 blinks on the display.
- Activate function block.
- Confirm setting.
- Select the function block for the sensor to be calibrated:
  The function blocks Co6 -> Fb01 to Fb17 correspond to the binary inputs BE1 to BE17 in the terminal wiring plan (–> page 78 onwards) depending on the selected system code number (Anl), e.g. Co6 -> Fb03 for sensor VFg (all systems).
- Activate editing mode for sensor.
  Fb_ blinks on the display.
- Display measured temperature.
- Activate editing mode for measured temperature.
  Measured temperature blinks.
- Correct measured temperature.
  Read the actual temperature directly from the thermometer at the point of measurement and enter this value as the reference temperature.
- Confirm corrected measured temperature.

Additional sensors are calibrated similarly.

- Select function block Fb23.
- Activate editing mode for function block Fb23.
- Deactivate function block Fb23.
- Confirm setting.
- Select ***End*** on the display.
- Exit the configuration level.
- Return to the operating level.

Note!
*The adjusted sensor values are not reset by the function for **resetting to default values**.*

2.6 Resetting to default values

All parameters and function blocks that can be set without entering the key number can be reset to their default settings (WE).

Proceed as follows:

- Reset to default settings.
  Function blocks and parameters are reset to their default settings (WE).

Note!
Resetting protected parameters to their default settings is only possible when the key number is still active.
The controller is ready for operation with its default settings. You just need to set the correct date and current time.

---

3 Manual operation

All the settings of the outputs can be set in the manual mode, see wiring plan (-> section 12).

Proceed as follows:

Set mode selector switch to .
After approx. 10 seconds the boilers start operation at full capacity. Display:

Select ***HAnd*** on the display.

Open the manual level. Display: ***bA1***

Select output:

bA: 1, 2	BA1 and BA2
3-Pt: 1, 2	BA3 and BA4, BA5 and BA6
PU: 1, 2	BA7 and BA8
StUF: 1, 2, 3, 4	BA9 to BA12
AnAL: 1, 2	AA 1, 2 (RK1, RK2)

Activate editing mode for output.
The display blinks.

Activate output, increase value.
Three-point stepping output: OPEN

or:

Deactivate output, decrease value.
Three-point stepping output: CLOSED

and:

Three-point stepping output: STOP

Confirm setting.
The changed values remain valid as long as the manual mode is active.

Slide mode switch to .

Exit the manual level.

Note!
In manual mode, ***frost protection*** *does not function.*

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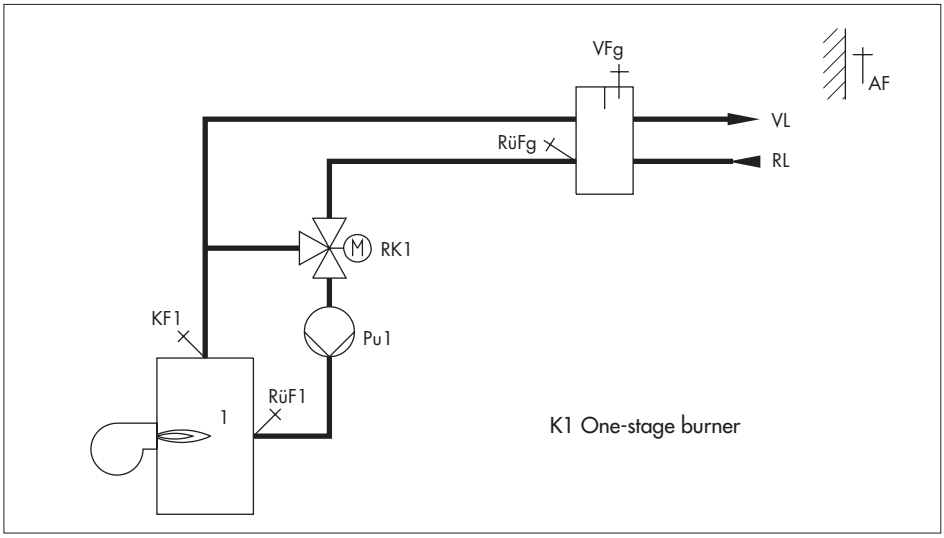
4 Systems

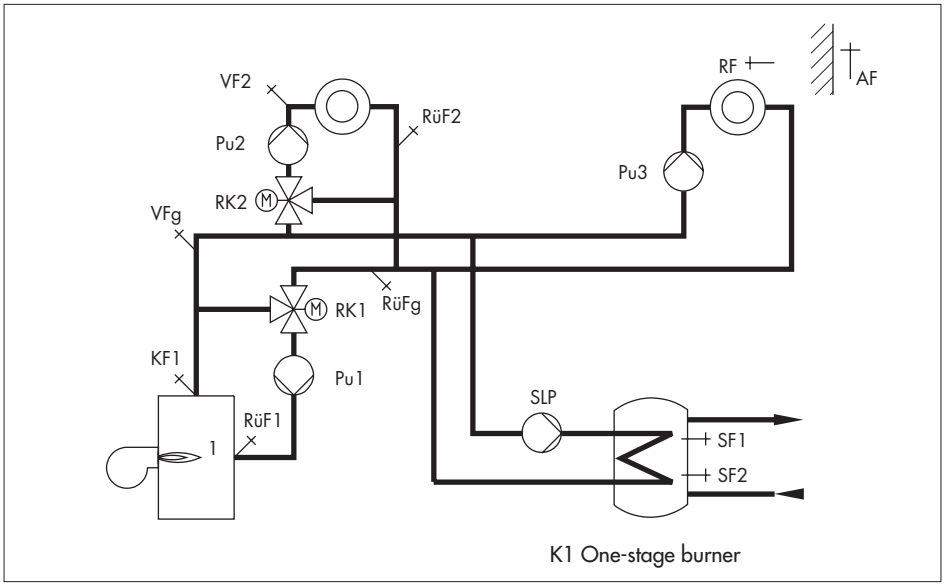
7 hydraulic schematics are available.

System code number (Anl)	System description	Comments
1	Single boiler for one-stage burner	Optionally separate heating circuit and DHW heating can be controlled
2	Single boiler for two-stage burner	
3	Single boiler for modulating burner	
4	Double boiler for one-stage condensing boiler and two-stage low-temperature boiler	Lag sequence without automatic lag/lead sequence change
5	Double boiler for 2 two-stage burners	Change in lag/lead sequence either depending on operating hours, on outdoor temperature or boiler capacity
6	Double boiler for modulating und two-stage burners	Lag sequence without automatic lag/lead sequence change
7	Double boiler for two modulating burners	Change in lag/lead sequence either depending on operating hours, on outdoor temperature or boiler capacity

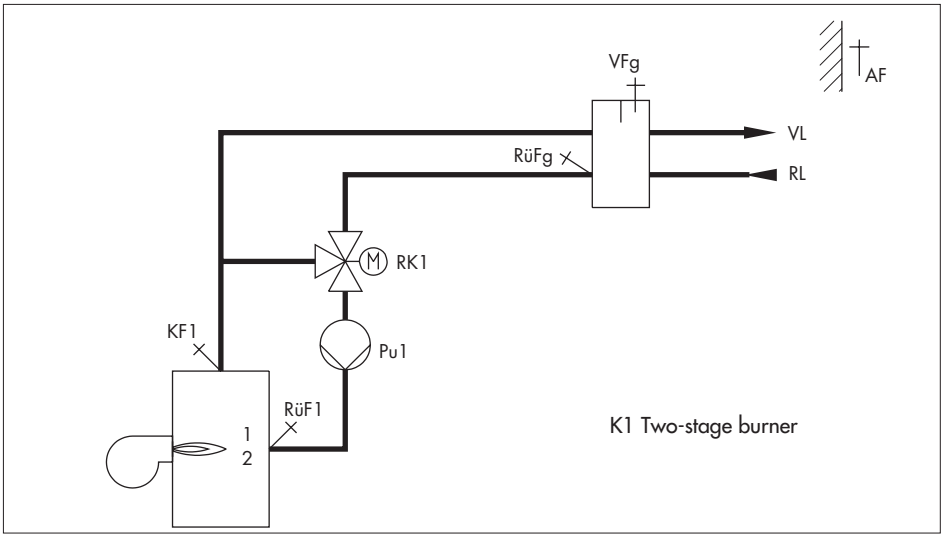
System Anl 1 with Co5 -> Fb13 = OFF



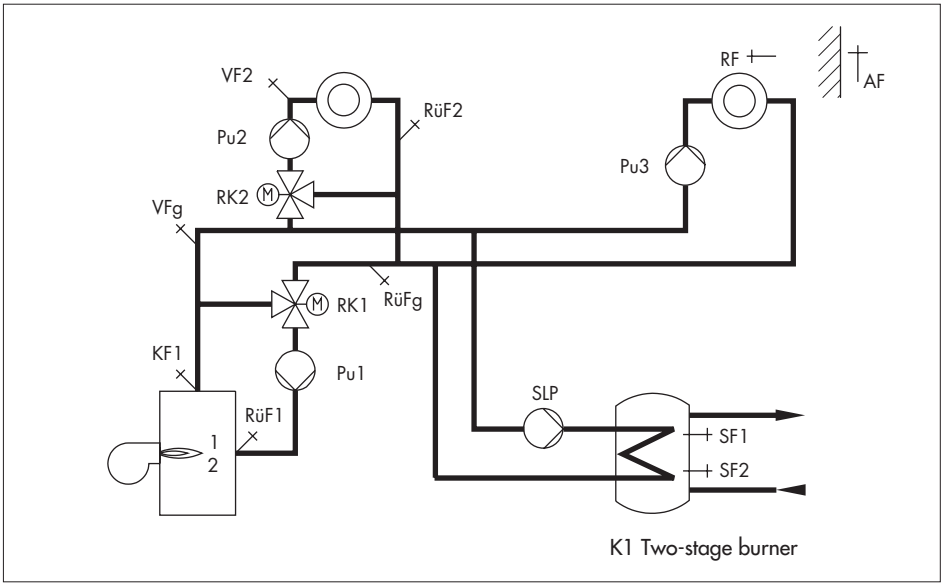
System Anl 1 with Co5 -> Fb13 = ON



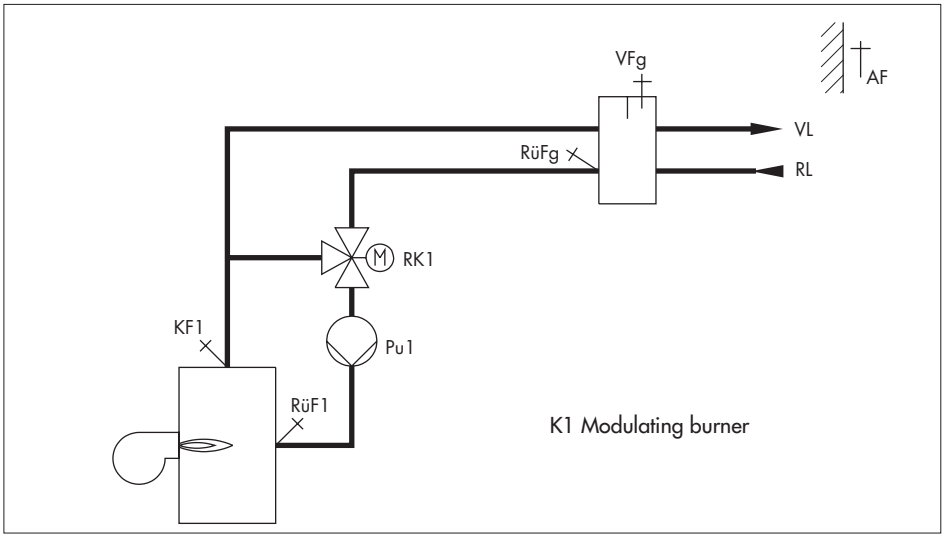
System Anl 2 with Co5 -> Fb13 = OFF



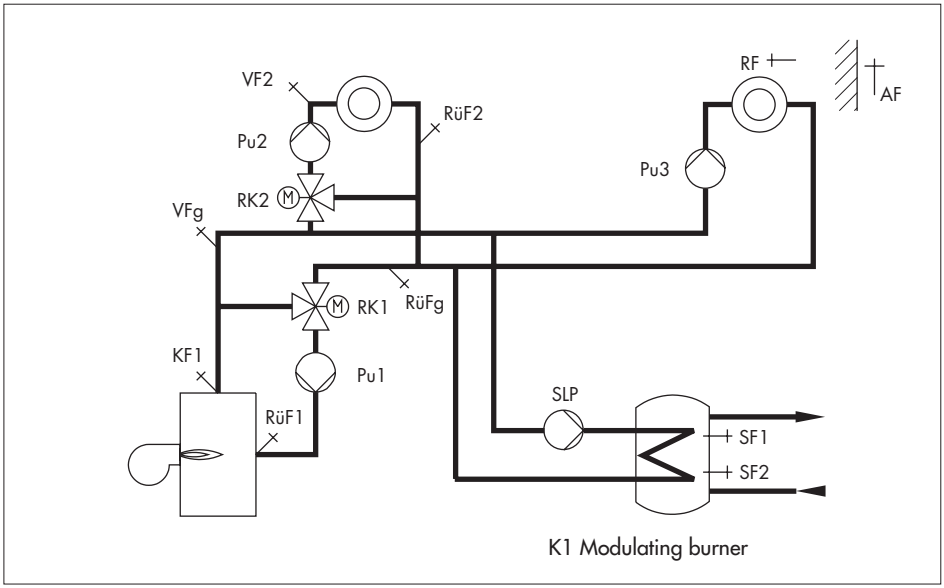
System Anl 2 with Co5 -> Fb13 = ON



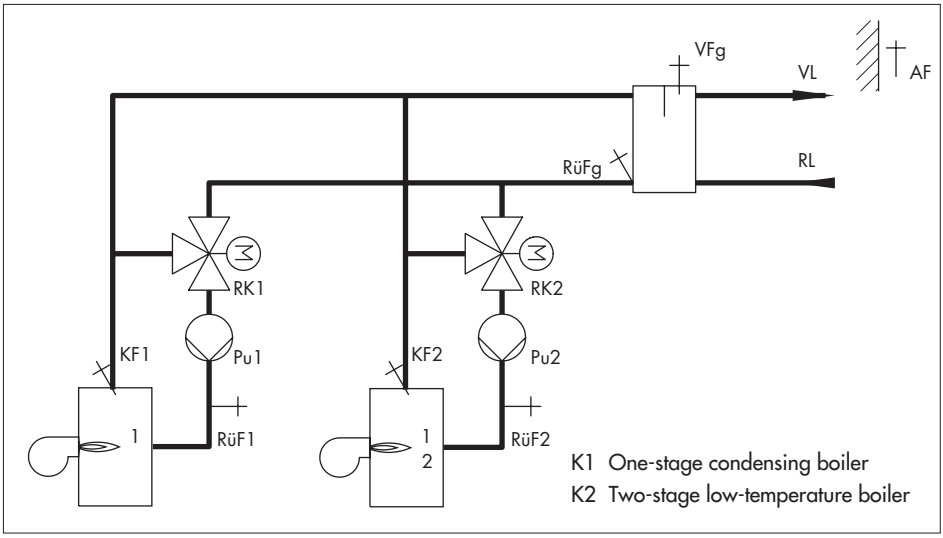
System Anl 3 with Co5 -> Fb13 = OFF



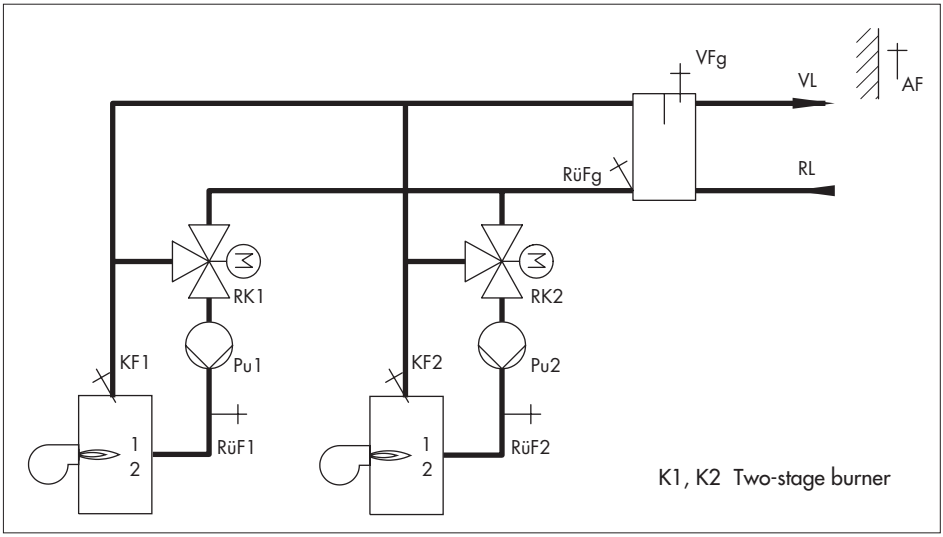
System Anl 3 with Co5 -> Fb13 = ON



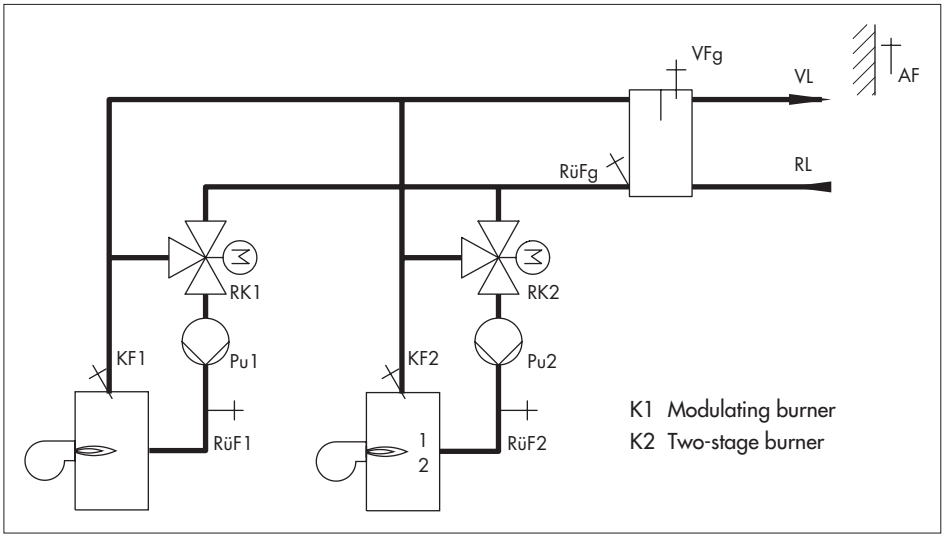
System Anl 4



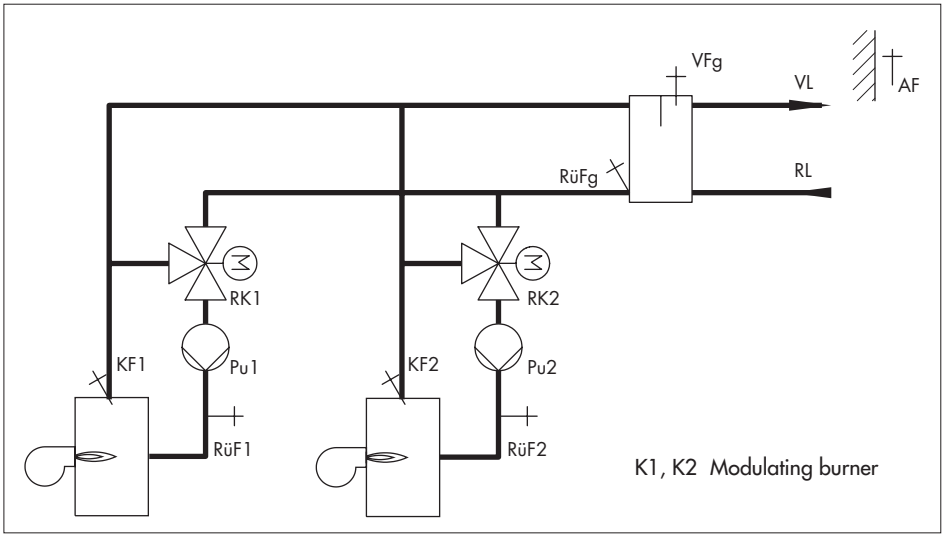
System Anl 5



System Anl 6



System Anl 7



5 Boiler functions

5.1 Boiler switching behavior

The *Minimum activation and deactivation time* parameters have priority over all other parameters described in following.
To be able to keep the cooling off periods between two activation phases, a boiler is first switched on when the time entered in *Minimum deactivation time* has passed since the last deactivation.
To ensure the burning of residues left over during the start-up phase, a boiler is switched off first after the time entered in *Minimum activation time* has elapsed.

Parameters	WE	Parameter level / Range of values
Minimum activation time	1 min	PA1, PA2* / 0 to 90 min
Minimum deactivation time	2 min	PA1, PA2* / 0 to 90 min
	* Only in systems Anl 4 to 7	

On/off boiler

A boiler is activated when the flow temperature falls below the flow temperature set point by the *Hysteresis* (Fig. 3). After the operational feedback message (burner firing –> section 5.10), the *Lockout time* must elapse before the boiler is switched to the next stage. If the flow temperature is expected to reach the set point range within the *Tolerance time*, the boiler does not switch to the next stage.
A boiler stage is switched off when the flow temperature exceeds the flow temperature set point by the *Hysteresis*.

Modulating boiler

A boiler starts to operate with its minimum capacity if the flow temperature falls below the flow temperature set point by the *Hysteresis* (Fig. 2). After the operational feedback message (burner firing –> section 5.10), the *Lockout time* must elapse before the modulation is enabled. The controller modulates the boiler capacity to match the actual energy requirement according to the flow temperature set point.

Parameters	WE	Parameter level / Range of values
Hysteresis	3 °C	PA5 / 1 to 20 °C
Tolerance time	30 min	PA5 / 0 to 99 min
Lockout time	2 min	PA5 / 0 to 99 min

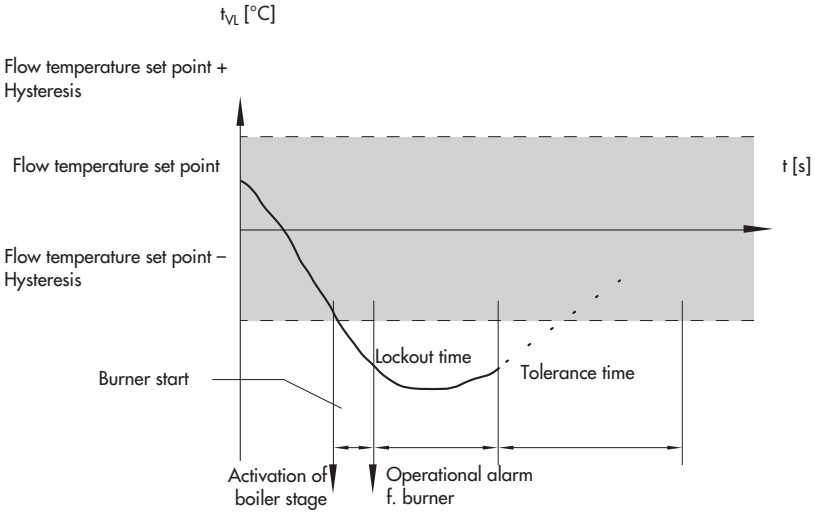


Fig. 3 · Criteria for switching the boiler stages

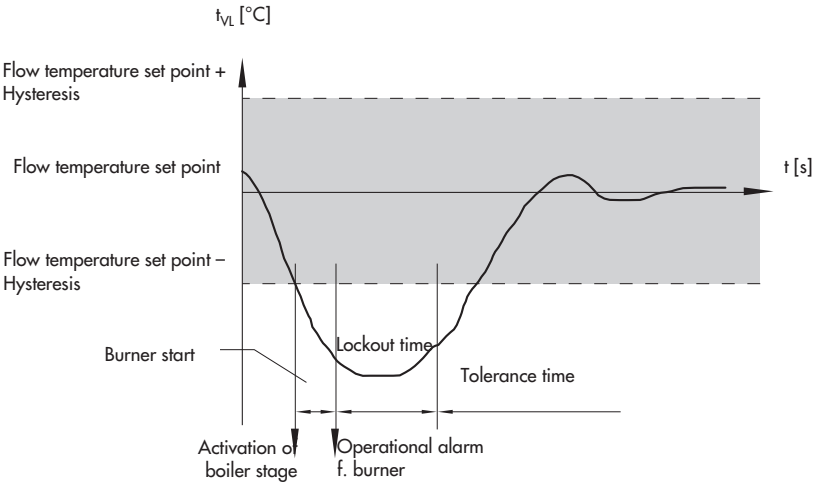


Fig. 2 · Criteria for switching the modulating boiler

5.2 Lag/lead sequence control

The boilers are released depending on the configuration:

- Co1, Co2* -> Fb00 = OFF: Boiler released according to the position of the mode selector switch
- Co1, Co2* -> Fb00 = ON: Boiler 1 is not released if binary input BE17 is closed, provided Boiler 1 is not locked by the mode switch.
  Boiler 2* is released if binary input BE16 is closed, provided Boiler 2 is not locked by the mode switch.

Function	WE	Configuration
Release of boiler K1, 2	OFF	Co1, Co2* -> Fb00
	* Only in systems Anl 4 to 7	

5.2.1 Control without sensor VFg

The **Burner activation independent from sensor VFg** function allows the boiler to be switched on independently from sensor VFg, i.e. exclusively according to boiler sensors VF1 and VF2. Other functions which have an effect on the lag and lead sequence control of the boiler in two-boiler systems do not affect the boiler which works independently any more.
On activating the **Continuous running of pump** function, the boiler pumps react like the pumps of master controller in normal systems.

Functions	WE	Configuration
Burner activation not dependent on sensor VFg	OFF	Co5 -> Fb20 = ON
Continuous running of pump	OFF	Co5 -> Fb14

5.2.2 Outdoor temperature-dependent sequence

If the outdoor temperature is above the limit entered in *Temperature t_A for releasing sequence,* just the lead boiler always remains in operation. The lag boiler is not even activated when the maximum capacity of the lead boiler is insufficient to achieve an increased flow temperature. The lag boiler is first released when the outdoor temperature is lower than the limit entered in *Temperature t_A for releasing sequence* after t = 2 x *Lockout time*.
The limit entered in *Temperature t_A for releasing sequence* must be selected to ensure that a short-term demand above the limit can be compensated for without any loss in comfort by prolonging the operating time of the lead boiler. This depends on the performance of the lead boiler.

Function	WE	Configuration
Releasing sequence	ON	Co5 -> Fb07 = ON

Parameters	WE	Parameter level / Range of values
Lockout time	2 min	PA5 / 0 to 99 min
Temperature t_A for releasing sequence	12 °C	PA5 / –40 to 50 °C

5.2.3 Capacity-dependent sequence

The lead boiler is activated when the flow temperature falls below the flow temperature set point by the *Hysteresis*. In the event of a demand for increased capacity, the lead boiler switches to the second stage. The second boiler is also activated if 90 % of its maximum load is not sufficient over the time period of t = 2 x *Lockout time* to increase the flow temperature to the required flow temperature set point and the set point hysteresis is not reached within the tolerance time.
The lag boiler is switched off when one of the following conditions is fulfilled:

- The current load of both boilers is less than 90 %.
- The actual temperature is greater than the set point and hysteresis added together as well as its tendency shows that the temperature will not fall below this total within the tolerance time.

Function	WE	Configuration
Releasing sequence	ON	Co5 -> Fb07 = OFF

Parameter	WE	Parameter level / Range of values
Lockout time	2 min	PA5 / 0 to 99 min

5.2.4 Sequence lock

The binary input BE11 is used to lock the sequence. The input of the outdoor temperature is determined by the binary input. The outdoor sensor is not required.

Function	WE	Configuration
Outdoor sensor	ON	Co5 -> Fb00 = OFF, **select:** FoAUS

5.2.5 Lag delay

The *Lag delay* parameter helps minimize losses during start-up in the event of short-term demands. The second boiler is first switched on when required after the time in *Lag delay* has elapsed. The time countdown is shown in the InF5 level.

Parameter	WE	Parameter level / Range of values
Lag delay	10 min	PA5 / 0 to 90 min

5.3 Change in lag/lead sequence (Anl 4 to 7)

The lag/lead sequence can be changed depending on the outdoor temperature, operating hours or capacity. The change in lag/lead sequence is only effective when the mode selector switch is set to 1+2 and with the configuration Co5 -> Fb20 = OFF.

Note!
A change in lag/lead always takes place when the controller detects a fault in the lead boiler regardless of the configuration.

5.3.1 Outdoor temperature-dependent change (Anl 5 and 7)

The outdoor temperature-dependent change in lag/lead sequence is only appropriate when boilers with varying capacity are used.
The lead boiler is determined by comparing the mean outdoor temperature over three days with the *Reverse sequence limit* t_A parameter:

- Outdoor temperature > *Outdoor temperature limit for lag/lead sequence change*: Lead boiler is the boiler with the smallest unit capacity
- Outdoor temperature < *Outdoor temperature limit for lag/lead sequence change*: Lead boiler is the boiler with the largest unit capacity

Functions	WE	Configuration
Automatic change in lag/lead sequence	ON	Co5 -> Fb09 = ON
Condition for change in lag/lead sequence	ON	Co5 -> Fb10 = OFF, **select:** 1

Parameter	WE	Parameter level / Range of values
Outdoor temperature limit for lag/lead sequence change	15 °C	PA5 / –40 to 50 °C

5.3.2 Capacity-dependent change (Anl 5 and 7)

The lead boiler is the boiler which had the lowest average capacity over the past three days.

Functions	WE	Configuration
Automatic change in lag/lead sequence	ON	Co5 -> Fb09 = ON

Condition for change in lag/lead sequence	ON	Co5 -> Fb10 = OFF, **select:** 2

5.3.3 Operating hours-dependent change (Anl 5 and 7)

After a fixed amount of time has elapsed, counting in hours from the time when the last lag/lead sequence took place (*Time interval for lag/lead sequence change)*, the other boiler takes on the role as lead boiler.
The elapsed operating hours since the last change in lag/lead sequence are shown in the InF5 level.

Functions	WE	Configuration
Automatic change in lag/lead sequence	ON	Co5 -> Fb09 = ON
Condition for change in lag/lead sequence	ON	Co5 -> Fb10 = ON
Parameter	WE	Parameter level / Range of values
Time interval for lag/lead sequence change	168 h	PA5 / 1 to 999 h

5.3.4 Change with binary input (Anl 4 to 7)

The binary input BE4 can be used for the change in lag/lead sequence when the DHW heating is not being controlled:

- BE4 = OFF: Boiler 1 as lead boiler
- BE4 = ON: Boiler 2 as lead boiler

Functions	WE	Configuration
DHW demand – active	ON	Co4 -> Fb00 = OFF
Automatic change in lag/lead sequence	OFF	Co5 -> Fb09 = OFF

Note!
In system Anl 7 the binary input BE4 can be used either for modulation feedback, for an external demand for DHW or for an external change in lag/lead sequence.

5.4 Return flow boost

On fulfilling the criteria for activation (–> section 5.1) the return flow control circuit is closed at the valve RK1/RK2. In the released boiler K1/K2 (see above), the first stage of the boiler and the boiler pump Pu1/Pu2 is switched on. The water is circulated in the boiler circuit.
The return control circuit is released if the temperature at the sensor RüF1/RüF2 exceeds the limit entered in *Minimum return flow temperature*. The mixing valve opens and release the cor-

responding flow rate to the plant until the valve is completely opened and the boiler pump delivers the maximum flow rate in the plant.

Parameter	WE	Parameter level / Range of values
Minimum return flow temperature	50 °C	PA1, PA2* / 20 to 120 °C
	* Only in systems Anl 4 to 7	

Depending on the configuration, the return flow boost can be controlled with a continuous signal, on/off signal or three-point stepping signal (–> section 8.11).

5.4.1 Common return flow boost

In systems with two boilers (systems Anl 4, 5, 6 and 7), a common return flow boost can be implemented. This is done by using the return flow control circuit of the first boiler K1, depending on whether the boiler is in operation.

Function	WE	Configuration
Common return flow boost	OFF	Co5 -> Fb12 = ON

5.5 **Parallel operation** (Anl 7)

This function leads to both boilers working constantly in parallel (no lag/lead sequence control).
The boilers start operating one after the other, taking into account the programmed times: *Minimum deactivation time for boiler K1, 2* and *Lag delay* as well as taking into account *Temperature t_A for releasing sequence*

Function	WE	Configuration
Parallel operation of boilers	OFF	Co5 -> Fb19 = ON
Parameters	WE	Parameter level / Range of values
Minimum deactivation time f. boiler K1, 2	0 min	PA1, 2 / 0 to 90 min
Lag delay	10 min	PA5 / 0 to 90 min
Temperature t_A for releasing sequence	12 °C	PA5 / –40 to 50 °C

5.6 Operating hours counter

This function allows the performed operating hours of boilers K1, 2 to be shown in the Inf1, 2 levels. The control is not affected by the counted operating hours. If the operating hours should be selected to start at a certain initial value, this can be programmed separately.

Function	WE	Configuration
Operating hours counter	OFF	Co1, Co2* -> Fb02 = ON
	0 h	Initial value / Configurable as required
		count Counting the operating hours
		rESEt Reset operating hours to initial value
	* Only in systems Anl 4 to 7	

5.7 Boiler pump control

The boiler pump control is connected with the boiler control loop.
When a boiler is switched on to the first stage, the associated boiler pump is also switched on. When the boiler is switched off, the boiler is switched off too either after the *Pump lag time* has elapsed or when the temperature falls below *Boiler flow limit*.

In summer mode, the boiler pump is switched off together with the boiler when the deactivation criteria are fulfilled.

In systems without hydraulic separator, in which the heating water must be circulated through the boiler, the boiler pump may not be switched off. For this purpose, the **Continuous running of pump** function is activated. The boiler pump continues to run when the lead boiler is switched off and the valve is opened. As a result, the cold system water can reach the boiler return flow pipe. If the return flow temperature is a factor that needs to be monitored in the boiler, the installation of an hydraulic separator is recommended.

Function	WE	Configuration
Continuous running of pump	OFF	Co5 -> Fb14 = ON
	5 min	Pump lag time / 0 to 90 min
	55 °C	Boiler flow limit / 20 to 120 °C

5.8 Boiler sensor acting as a thermostat

The boiler sensors KF1 and KF2 control the safety deactivation (–> section 8.10), which is triggered whenever the maximum flow temperature is exceeded, as well as the temperature-dependent pump lag of the boiler pumps Pu1 and Pu2 (–> section 5.7).
The maximum permissible flow temperature can also be monitored in systems Anl 4, 5 and 6 with thermostats. The inputs of the boiler sensors must be defined as binary inputs for this purpose. The thermostats are connected to the same terminals as the boiler sensors.

Function	WE	Configuration
Boiler sensor KF1, 2	ON	Co1, Co2* -> Fb03 = OFF StEiG: Thermostat closes FALL: Thermostat opens
	*Only in systems Anl 4 to 7	

5.9 Modulation feedback

The modulation feedback in systems Anl 3, 6 and 7 can be implemented by a potentiometer (1 to 2 kΩ) or by a limit switch for maximum boiler capacity output.

Modulation feedback with potentiometer
The inputs for the potentiometer are marked in the wiring diagrams (–> section 12) with SG_K1 (potentiometer 1) and with SG_K2 (potentiometer 2).

Function	WE	Configuration
Modulation feedback K1, 2	ON	Co1, Co2* -> Fb07 = ON
	* Only in system Anl 7	

Note!
In system Anl 7, the binary input BE4 can be used either for modulation feedback, for external DHW demand or for external change in lag/lead sequence.

5.10 Operational alarm

The boiler controller waits for an operational alarm before it continues (–> section 5.1). The operational alarm can optionally be issued over a binary input or after fixed time entered in *Start-up time for boiler* parameter.

Operational alarm over a binary input

The inputs for the operational alarm are marked in the wiring diagrams (section 12) with BE2 BM_K1 for Boiler 1 and with BE1 BM_K2 for Boiler 2.

Function	WE	Configuration
Operational alarm K1, 2	ON	Co1, Co2* -> Fb01 = ON
	* Only in systems Anl 4 to 7	

Operational alarm after start-up

Function	WE	Configuration
Operational alarm K1, 2	ON	Co1, Co2* -> Fb01 = OFF
	0 s	Start-up time for boiler / 0 to 5400 s
	* Only in systems Anl 4 to 7	

5.11 Return flow sensor acting as a thermostat

The return flow sensors can optionally be replaced by thermostats. For this purpose, the inputs for the return flow sensors are defined as binary inputs. The thermostats are connected to the same terminals as the return flow sensors.

Function	WE	Configuration
Return flow sensor RüF1, 2	ON	Co1, Co2* -> Fb04 = OFF StEiG: Thermostat closes FALL: Thermostat opens
	* Only in systems Anl 4 to 7	

6 Functions of the heating circuit

6.1 Outdoor temperature-dependent advance heating

Only selectable for systems Anl 1 to 3 with Co5 -> Fb13 = ON.
The controller switches the heating on before the time-of-use starts in normal operation depending on the outdoor temperature. The *Advance heating time* is based on an outdoor temperature of –12 °C. The advance heating time is shortened in case of higher outdoor temperatures.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co5 -> Fb13 = ON
Optimization	OFF	Co3 -> Fb05 = ON, ***select:*** *1*
	120 min	Advance heating time / 0 to 360 min
Outdoor sensor	ON	Co5 -> Fb00 = ON

6.2 Optimization using a room sensor

Only selectable for systems Anl 1 to 3 with Co5 -> Fb13 = ON.
Both the functions described should only be used if the room in which the room sensor is located (reference room) has a heating characteristic that is similar to the rest of the building.
No thermostat valves should be mounted on the radiators in the reference room.

There are two types of optimization depending on the activation conditions:

- **Outdoor temperature-dependent advance heating, room temperature-dependent deactivation**
  The controller activates the heating depending on the outdoor temperature before the time-of-use starts in normal operation. The *Advance heating time* is based on an outdoor temperature of –12 °C. The advance heating time is shorter when the outdoor temperature is higher (see section 6.1).
- **Room temperature-dependent advance heating and deactivation**
  The controller calculates the required advance heating time (max. 6 hours) adapted to the building characteristics, resulting in the *Day set point* (rated room temperature) being reached in the reference room when the time-of-use starts. The heating is heated with the maximum flow temperature during the advance heating phase. As soon as the *Day set point* is reached, outdoor temperature-dependent control starts.

The controller deactivates the heating in both types of optimization depending on the room sensors up to two hours before the time-of-use finishes.

The controller chooses the deactivation time such in a way that the room temperature does not drop significantly below the desired temperature until the time-of-use ends.

Outside the times-of-use, the controller monitors the *Night set point* (reduced room temperature) or the *Sustained temperature* in the case of room temperature-dependent deactivation. When the temperature falls below the night set point, the controller heats with the max. flow temperature until the measured room temperature exceeds the adjusted value by 1 °C.

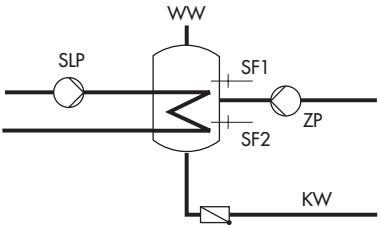
Note!
Direct sunshine can cause the room temperature to increase and thus result in the premature deactivation of the heating system.
A drop in room temperature within a brief period outside of the time-of-use may lead to the advance heating to reach the room temperature being activated too early.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co5 -> Fb13 = ON
Room sensor	OFF	Co3 -> Fb00 = ON
Outdoor temperature-dependent advance heating, room temperature-dependent deactivation:		
Optimization	OFF	Co3 -> Fb05 = ON, ***select:*** *2*
	120 min	Advance heating time / 0 to 360 min
Outdoor sensor AF1 to 3	ON	Co5 -> Fb00 = ON
Room temperature-dependent advance heating and deactivation:		
Optimization	OFF	Co3 -> Fb05 = ON, ***select:*** *3*
Parameter	WE	Parameter level / Range of values
Day set point	20 °C	PA3 / 10 to 40 °C
Night set point	17 °C	PA3 / 10 to 40 °C
Sustained temperature	10 °C	PA3 / 10 to 40 °C

7 Functions of the DHW circuit

Only systems Anl 1 to 3 have their own DHW heating (DHW heating in storage system with Co5 -> Fb13 = ON).
The systems Anl 4 to 7 do not have their own DHW heating; they are, however, able to process an external DHW demand (-> section 7.4) and to reduce an excessively high flow temperature over a DHW forced charging in the external system (-> section 7.2).

7.1 DHW heating in the storage tank system (Anl 1 to 3)



SLP	Storage tank charging pump
SF1	Storage tank sensor 1
SF2	Storage tank sensor 2
ZP	Circulation pump
WW	Hot water
KW	Cold water

Fig. 4 · DHW heating in a storage tank system

Operation with storage tank sensor SF1

The controller begins charging the storage tank when the water temperature measured at sensor SF1 falls below the set point *DHW demand ON*. The controller stops charging the storage tank when the water temperature in the storage tank measured at sensor SF1 reaches the value T = *DHW demand ON* + *Hysteresis*.

The set point *Boiler set point for DHW demand* determines the set point at sensor VFg.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co5 -> Fb13 = ON
Storage tank sensor SF1	OFF	Co4 -> Fb03 = ON
Storage tank sensor SF2	OFF	Co4 -> Fb04 = OFF
Parameters	WE	Parameter level / Range of values
Boiler set point for DHW demand	65 °C	PA4 / 20 to 120 °C
DHW demand ON	40 °C	PA4 / 20 to 90 °C
Hysteresis	5 °C	PA4 / 0 to 30 °C

Operation with two storage tank sensors SF1 and SF2
The controller begins charging the storage tank when the water temperature measured at sensor SF1 falls below the set point *DHW demand ON*. The controller stops charging the storage tank when the water temperature in the storage tank measured at sensor SF2 reaches the value *DHW demand OFF*.

The set point *Boiler set point for DHW demand* determines the set point at sensor VFg.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co5 -> Fb13 = ON
Storage tank sensor SF1	OFF	Co4 -> Fb03 = ON
Storage tank sensor SF2	OFF	Co4 -> Fb04 = ON
Parameters	WE	Parameter level / Range of values
Boiler set point for DHW demand	65 °C	PA4 / 20 to 120 °C
DHW demand ON	40 °C	PA4 / 20 to 90 °C
DHW demand OFF	45 °C	PA4 / 20 to 90 °C

Operation with storage tank thermostat
The storage tank thermostat is connected to SF1 and switches the storage tank charging on and off. The set point *Boiler set point for DHW demand* must still be predetermined.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co4 -> Fb13 = ON
Storage tank sensor SF1	OFF	Co4 -> Fb03 = OFF
Storage tank sensor SF2	OFF	Co4 -> Fb04 = OFF
Parameter	WE	Parameter level / Range of values
Boiler set point for DHW demand	65 °C	PA4 / 20 to 120 °C

7.1.1 **Priority circuit** (Anl 1 to 3)

The DHW heating can be switched with priority over the separate heating circuit 2 or directly over the heating circuit (heating circuit 3, Pu3).

Heating circuit 2:
During the storage tank charging, the separate heating circuit 2 is placed in reduced operation.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co5 -> Fb13 = ON
DHW priority over HK2	OFF	Co4 -> Fb06 = ON

Heating circuit 3:
During the storage tank charging, the direct heating circuit is switched off. The separate heating circuit runs in parallel.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co5 -> Fb13 = ON
DHW priority over HK3	OFF	Co4 -> Fb07 = ON

Note!
*When the **DHW priority over HK3** function is deactivated, the direct heating circuit also runs in parallel to the DHW charging. The heating circuit may, however, only be overheated by 10 °C . In other words, the heating circuit is supplied with not enough heat when the boiler set point for the heating circuit is greater than* Boiler set point for DHW demand. *The heating circuit is switched off during storage tank charging when the* Boiler set point for DHW demand *is 10 °C higher than the boiler set point.*

7.2 Forced charging of the DHW storage tank (Anl 1 to 7)

A forced charging of the DHW storage tank can prevent that the safety equipment place the boiler out of operation in case of excessively high flow temperature.
The forced charging of the DHW storage tank takes place when the *Maximum limit for DHW forced charging* is exceeded at the flow sensor together with sensor VFg or at one of the two boiler sensors KF1 or KF2.
In systems without their own DHW heating (systems Anl 4 to 7) the demand for a forced charging is passed on to the connected controllers at binary output BA1. The actual forced charging is started by the controllers that are responsible for the DHW heating.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co5 -> Fb13 = ON*
Forced charging of DHW storage tank	OFF	Co4 -> Fb02 = ON
	80 °C	Maximum limit f. DHW forced charging/20 to 120 °C
	* Not in systems Anl 4 to 7	

7.3 **Thermal disinfection** (Anl 1 to 3)

In all systems with DHW heating, the DHW storage tank is thermally disinfected on the selected *Day of week* or daily. The storage tank is heated up to the adjusted *Disinfection temperature*. The charging temperature is always 5 °C higher than the *Disinfection temperature*.

Thermal disinfection starts at the adjusted *Start time* and finishes at the *Stop time* at the latest. If the *Disinfection temperature* is not reached at the end of thermal disinfection, blinks on the display. The error alarm is automatically reset when the *Disinfection temperature* is reached during the next thermal disinfection.

Thermal disinfection for preventing legionella infection causes
- high return flow temperatures during the disinfection cycle (return flow temperature limitation suspended),
- high storage tank temperatures after thermal disinfection has been concluded,
- lime scale (possibly), which can have a negative effect on heat exchanger performance.

Note!
This function is not available when a storage tank thermostat is used.

Functions	WE	Configuration
Heating circuit with DHW heating	OFF	Co5 -> Fb13 = ON
Storage tank sensor SF1	OFF	Co5 -> Fb03 = ON
Thermal disinfection	OFF	Co4 -> Fb08 = ON
	3	Day of week / 0, 1 to 7 (daily, Mon to Sun)
	70 °C	Disinfection temperature / 50 to 80 °C
	00:00	Start time / 00:00 to 23:59 h
	04:00	Stop time / 00:00 to 23:59 h

7.4 External DHW demand (Anl 1 to 7)

This function allows the boiler controller to switch over to the *Boiler set point for DHW demand* when the binary input BE4 (WWA) is closed. The thermal disinfection has priority when the external DHW demand and thermal disinfection coincide.

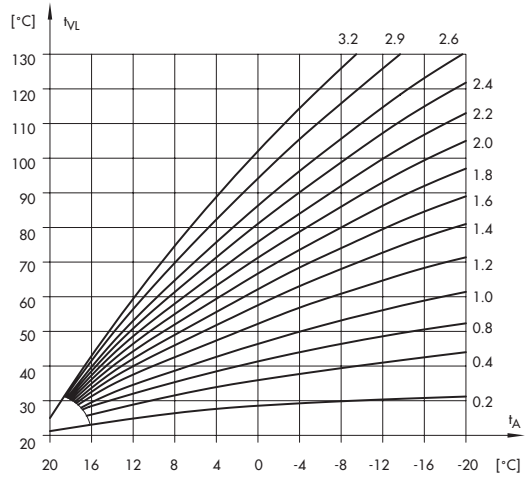
Functions	WE	Configuration
Modulation feedback K2	ON	Co2 -> Fb07 = OFF
DHW demand – active	ON	Co4 -> Fb00 = ON
Parameter	WE	Parameter level / Range of values
Boiler set point for DHW demand	65 °C	PA4 / 20 to 120 °C

Note!
In system Anl 7, the binary input BE4 can be used either for modulation feedback, for external DHW demand or for external change in lag/lead sequence.

8 System-wide functions

8.1 Weather-compensated control

When weather-compensated control is used, the flow temperature is controlled according to the outdoor temperature. The boiler characteristic in the controller defines the flow temperature set point as a function of the outdoor temperature (–> Fig. 5). The outdoor temperature required for weather-compensated control is measured at the outdoor sensor at the input AF or received over a 0 to 10 V signal at the input AE2.



t_{VL} Flow temperature
t_A Outdoor temperature

Fig. 5 · Gradient characteristic

Caution!
Pt 100 or Pt 1000 sensor should be used for measuring the flow temperature as only these sensors guarantee measurements up to 160 °C (max. temperature of the flow temperature set point).

Function	WE	Configuration
Outdoor sensor	ON	Co5 -> Fb00 = ON FUEHL: Outdoor temperature sensor AF 0–10: 0 to 10 V signal
	3 °C	Frost protection limit / –30 to 20 °C*
	* See section 8.8	

8.1.1 Gradient characteristic

Basically, the following rule applies: a decrease in the outdoor temperature causes the flow temperature to increase. By varying the *Gradient* and *Level* parameters, you can adapt the characteristic to your individual requirements. Increasing *Gradient* results in a higher flow temperature, decreasing *Gradient* in a lower flow temperature. The *Level* parameter performs a parallel transport of the heating characteristic in an upward or downward direction.

Outside the times-of-use, reduced set points are used for control:
Reduced flow set point = *Flow set point – Set-back difference*.
The *Max. flow temperature* and *Min. flow temperature* parameters mark the upper and lower limits of the flow temperature. A separate gradient characteristic can be selected for the limitation of the return flow temperature.

Examples for adjusting the characteristic:

- Old building, radiator design 90/70: Gradient approx. 1.8
- New building, radiator design 70/55: Gradient approx. 1.4
- New building, radiator design 55/45: Gradient approx. 1.0
- Underfloor heating depending on arrangement: Gradient smaller 0.5

Functions	WE	Configuration
Type of characteristic	OFF	Co5 -> Fb03 = ON, **select:** 2
Type of characteristic for separate/direct heating circuit*	ON	Co2, Co3 -> Fb10 = ON, **select:** 2*
	* Only in systems Anl 1 to 3 with Co5 -> Fb13 = ON	

Parameters	WE	Parameter level / Range of values
Gradient, flow	1.8	PA2*, PA3*, PA5 / 0.4 to 3.2
Level, flow	0 °C	PA2*, PA3*, PA5 / –30 to 30 °C
Set-back difference	15 °C	PA2*, PA3*, PA5 / 0 to 30 °C
Max. flow temperature	90 °C	PA2*, PA3* / 20 to 160 °C
Min. flow temperature	20 °C	PA2*, PA3* / 20 to 120 °C
	* Only in systems Anl 1 to 3 with Co5 -> Fb13 = ON	

8.1.2 4-point characteristic

The 4-point characteristic allows you to define your own heating characteristic.
It is defined by 4 points for the *Outdoor temperature* and the *Flow temperature*. The *Boiler set-back difference* is predetermined for points P1 and P2 and for points P3 and P4 in the corresponding parameter level, resulting in the dashed line in Fig. 6.

The *Max. flow temperature* and *Min. flow temperature* parameters mark the upper and lower limits of the flow temperature.

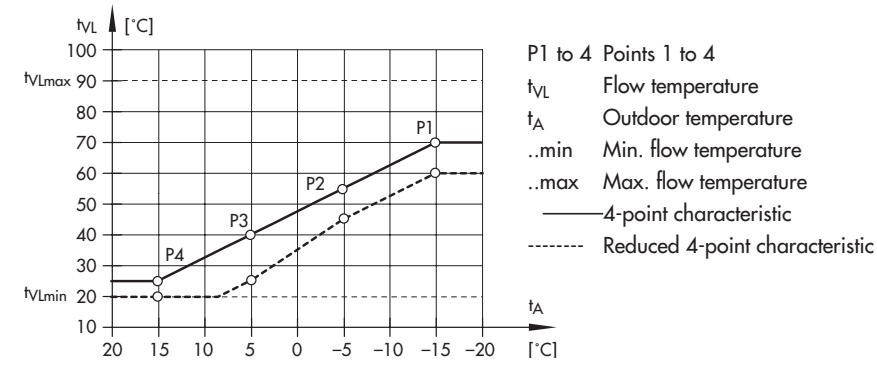


Fig. 6 · 4-point characteristic

Functions	WE	Configuration
Type of characteristic	OFF	Co5 -> Fb03 = ON, **select:** 1
Type of characteristic for separate/ direct heating circuit*	OFF	Co2, Co3 -> Fb10 = ON, **select:** 1*
	* Only in systems Anl 1 to 3 with Co5 -> Fb13 = ON	

Parameters		WE	Parameter level / Range of values
Outdoor temperature	Point 1	–10 °C	PA2*, PA3*, PA5 / –20 to 50 °C
	Point 2	– 5 °C	
	Point 3	5 °C	
	Point 4	10 °C	
Flow temperature	Point 1	90 °C	PA2*, PA3*, PA5 / 20 to 160 °C
	Point 2	80 °C	
	Point 3	68 °C	
	Point 4	50 °C	
Set-back difference	Points ½	15 °C	PA2*, PA3*, PA5 / 0 to 30 °C
	Points 3/4	20 °C	
Max. flow temperature		90 °C	PA2*, PA3* / 20 to 160 °C
Min. flow temperature		20 °C	PA2*, PA3* / 20 to 120 °C
			* Only in systems Anl 1 to 3 with Co5 -> Fb13 = ON

8.2 Fixed set point control

During the times-of-use, the flow temperature can be controlled according to a fixed *Set point*. Outside the times-of-use, this *Set point* is reduced by the *Set-back difference*.

The fixed set point control is activated when there is no outdoor sensor AF connected to the system or when it has been configured in the function block **Type of characteristic**. In the case that the fixed set point control is configured and an outdoor sensor is connected, the outdoor temperature is displayed in the InF5 level. The outdoor temperature does not have any effect on the control loop.

Functions	WE	Configuration
Type of characteristic	OFF	Co5 -> Fb03 = OFF
Type of characteristic for separate/ direct heating circuit*	OFF	Co2, Co3 -> Fb10 = OFF*
		* Only in systems Anl 1 to 3 with Co5 -> Fb13 = ON

Parameters	WE	Parameter level / Range of values
Flow temperature set point	70 °C	PA2*, PA3*, PA5 / 20 to 160 °C
Set-back difference	15 °C	PA2*, PA3*, PA5 / 0 to 30 °C
		* Only in systems Anl 1 to 3 with Co5 -> Fb13 = ON

8.3 Differential temperature control using variable weighting factors

This function allows the return flow temperature, total (RüFg) to be taken into account in the control loop, in addition to the flow temperature, total (VFg).
The difference between the flow temperature, total (VFg) and return flow temperature, total (RüFg) is specified using the *Intended temperature difference* parameter. It is a measure for the energy consumption in a heating circuit. The greater the temperature difference, the larger the energy required by a heating circuit. If the actual temperature difference is not the same as the intended temperature difference, it is evaluated by the *Kp factor for differential temperature control*. After initial signs for a deviation occur, the flow temperature is raised or reduced by this factor.
When the *Kp factor for differential temperature control* is set to 0, the return flow temperature does not have any effect on the control of the flow temperature.
When the *Kp factor for differential temperature control* is set to 1, a pure return flow temperature limitation takes place.

Function	WE	Configuration
Return flow sensor, total RüFg	OFF	Co5 -> Fb02 = ON
	10 °C	Intended temperature difference / 0 to 90 °C
	0.5	Kp factor for differential temperature control / 0 to 1

8.4 Deactivation depending on outdoor temperature

The controller switches to the stand-by mode when *Outdoor temperature limit causing change to summer mode in rated operation* during times-of-use or *Outdoor temperature limit causing change to summer mode in reduced operation* outside times of use is exceeded.

Should the temperature fall below the limit, the heating is started again. The function for deactivation depending outdoor temperature is set by default.

Parameter	WE	Parameter level / Range of values
Outdoor temperature limit causing change to summer mode in rated operation	22 °C	PA5 / 0 to 50 °C
Outdoor temperature limit causing change to summer mode in reduced operation	10 °C	PA5 / –10 to 50 °C

8.5 Summer mode

Summer mode is activated depending on the mean daytime temperature (measured between 7.00h and 22.00h) during the desired period.
If the mean daytime temperature exceeds the *Outdoor temperature limit* on two consecutive days, summer mode is activated on the following day: the heating is switched off. If the mean daytime temperature remains below the *Outdoor temperature limit* on the next day, summer mode is deactivated on the following day.

Function	WE	Configuration
Summer mode	ON	Co5 -> Fb06 = ON
	01.06	Start summer mode / 01.01 to 31.12
	30.09	Stop summer mode / 01.01 to 31.12
	18 °C	Outdoor temperature limit /0 to 40 °C

8.6 Delayed outdoor temperature adaptation

The calculated outdoor temperature is used to determine the flow temperature set point. The heat response is delayed when the outdoor temperature either decreases, or increases and decreases. If the outdoor temperature varies by, for example, 12 °C within a very short period of time, the calculated outdoor temperature is adapted to the actual outdoor temperature in small steps. Assuming a *Delay* of 3 °C/h, the adaptation would take $t = \frac{12°C}{3°C/h} = 4$ h.

Note!
The delayed outdoor temperature adaptation helps avoid unnecessary overloads of central heating stations in combination with either overheated buildings occurring, for example, due to warm winds, or temporarily insufficient heating due to the outdoor sensor being exposed to direct sunshine.

Function	WE	Configuration
Delayed outdoor temperature adaptation	OFF	Co5 -> Fb01 = ON
		AB Delay on decreasing temperature
		ABAUF Delay on decreasing and increasing temperature
	3 °C/h	Delay / 1 to 6.0 °C/h

8.7 Automatic summer time/winter time changeover

The clock is automatically adjusted on the last Sunday in March at 2.00h and on the last Sunday in October at 3.00h.

Function	WE	Configuration
Summer time/winter time changeover	ON	Co5 -> Fb05 = ON

8.8 Frost protection

To protect the system from freezing up, the flow temperature or return flow temperature are monitored.

Note!
The frost protection function is not activated when manual mode is selected at the mode switch.

Flow temperature monitoring
The flow temperature cannot drop enough to cause the pipes to freeze when the controller is in rated or reduced operation. In stand-by mode, the flow temperature is not regulated. Therefore, it is monitored. Should the flow temperature fall below 3 °C, the flow temperature is restricted to the minimum return flow temperature.

Return flow temperature monitoring
The outdoor temperature is monitored at the input AF (outdoor sensor) or at the input AE2 (0 to 10 V signal). In both cases, the *Frost protection limit* (–30 to 30 °C, WE: 3 °C with Co5 -> Fb00 = ON) must be defined to monitor this parameter.
Alternatively, a frost protection thermostat can also be used for monitoring. This requires input AF to be configured as a binary input (BE11) (Co5 -> Fb00 = OFF, FroSt).
If there is no boiler in operation and the outdoor temperature falls below the frost protection limit or if the binary input of the frost protection thermostat is active, the pumps are activated and the valves opened. As a result, the system or individual parts of the system cannot freeze.

Function	WE	Configuration
Outdoor sensor	ON	Co5 -> Fb00

8.9 Forced operation of the pumps

When the pumps (Pu1, Pu2 and Pu3) have not been activated for 24 hours, forced operation of the pumps is started between 12.00h and 12.01h. The forced operation of the storage tank pump SLP is operated between 12.01h and 12.02h.

8.10 Flow temperature limitation

The boiler temperature is regulated to the limit set in *Maximum flow temperature* and an alarm is displayed when the flow temperature at the boiler outlet of a modulating burner reaches the limit *Maximum flow temperature + Temperature rise*.
The limitation is stopped again when the flow temperature falls below the limit set in *Maximum flow temperature*.
During the active limitation, the boiler temperature blinks in InF1 and InF2 levels. Press ⊠ to read the limit.

Function	WE	Configuration
Boiler sensor KF1, 2	ON	Co1, Co2* -> Fb03 = ON
	* Only in systems Anl 4 to 7	
Parameters	WE	Parameter level / Range of values
Maximum flow temperature KF1, 2	90 °C	PA1, PA2* / 20 to 160 °C
Temperature rise	10 °C	PA5 / 0 to 30 °C
	* Only in systems Anl 4 to 7	

Note! *The controller cannot replace a safety temperature limiter.*

The flow temperature is monitored by a thermostat when the function is deactivated. The input of the flow sensor is defined as a binary input. The thermostat is connected to terminals 24 (RK1) or 25 (RK2).

Function	WE	Configuration
Boiler sensor KF 1, 2	ON	Co1, Co2* -> Fb03 = OFF StEiG Thermostat closes FALL Thermostat opens
	*Only in systems Anl 4 to 6	

Note! *The sensor inputs VF1 and VF2 cannot be used as thermostat inputs in system Anl 7.*

8.11 Control mode

The selected control mode (section 8.11.1 to 8.11.3) of the return flow boost affects the control mode of the modulation and vice versa. The following connection applies:

- Return flow boost in continuous control <–> Modulation in three-point
- Return flow boost in on/off or three-point control <–> Modulation in continuous

On using modulating burners (systems Anl 6 and 7), the default setting of the control signal for the return flow boost is configured to be continuous (Co1, 2 -> Fb05 = ON) and the modulation control uses a three-point signal. With Co1, 2 -> Fb05 = OFF, this assignment is reversed, meaning that the modulating burners can also be controlled with a continuous signal.

Setting for return flow boost: continuous control; Modulation: three-step control

Functions	WE	Configuration
RüL-RK1, 2		Co1, Co2* -> Fb05 = ON
	6	K_P (proportional gain) / 0.1 to 99.9
	120 s	T_N (reset time) / 0 to 999 s
	0 s	T_V (derivative-action time) / 0 to 999 s

Setting for return flow boost: three-step control; Modulation: continuous control

Functions	WE	Configuration
RüL-RK1, 2		Co1, Co2* -> Fb05 = OFF
	6	K_P (proportional gain) / 0.1 to 99.9
	120 s	T_N (reset time) / 0 to 999 s
	0 s	T_V (derivative-action time) / 0 to 999 s
	120 s	T_Y (valve transit time) / 5 to 240 s
3-step pulsing/on-off signal RüL-RK1, 2	OFF	Co1, Co2* -> Fb06 = ON

Setting for return flow boost: on/off control; Modulation: continuous control

Functions	WE	Configuration
RüL-RK1, 2		Co1, Co2* -> Fb05 = OFF
	6	K_P (proportional gain) / 0.1 to 99.9
	120 s	T_N (reset time) / 0 to 999 s
	0 s	T_V (derivative-action time) / 0 to 999 s
	120 s	T_Y (valve transit time) / 5 to 240 s
3-step pulsing/on-off signal RüL-RK1, 2	OFF	Co1, Co2* -> Fb06 = OFF
	5 °C	Hysteresis / 1 to 30 °C
	120 s	Min. activation time / 0 to 600 s
	120 s	Min. deactivation time / 0 to 600 s

* Only in systems Anl 4 to 7

Note!
The control mode is configured separately in Co2 -> Fb14 or Fb15 for the separate heating circuit in systems Anl 1 to 3 (Co5 -> Fb13 = ON).

8.11.1 Three-step control

The set point can be controlled using a PI algorithm. The valve reacts to pulses that the controller emits when a system deviation occurs. The length of the first pulse. in particular, depends on the extent of the system deviation and the selected *Proportional gain* K_P (the pulse length increases as K_P increases). The pulse and pause lengths change continuously until the system deviation has been eliminated. The pause length between the single pulses is greatly influenced by the *Reset time* T_N (the pause length increases as T_N increases).
The *Transit time* T_Y specifies the time required by the valve to travel through the range of 0 to 100 %.

8.11.2 On/off control

The output signal of the controller is switched on or off.
Depending on the controlled variable, the output signal is switched on or off when the temperature falls below or exceeds the required set point by T = 0.5 x *Hysteresis*. The greater the *Hysteresis* selected, the less the signal is switched on and off. The *Minimum activation time* and *Minimum deactivation time* determine the time interval between changes in the output signal.

8.11.3 Continuous control

The set point can be controlled using a PID algorithm. The valve receives an analog 0 to 10 V signal from the controller. The proportional component causes an immediate change in the 0 to 10 V signal when a system deviation occurs (the greater the K_P, the greater the change). The integral-action component only comes into effect when a certain time has passed: T_N stands for the time passing until the integral-action component has changed the output signal to the extent that the proportional component directly changed the signal (the greater the T_N, the slower the rate of change). The derivative-action component determines how strongly a change in the system deviation affects the output signal (the greater the T_V, the stronger the change).

8.12 Control signal deactivation

This function protects three-point stepping actuators without final position deactivation from overloading by monitoring the total of the control signal pulses. No further control signals are issued if it exceeds three times the *Valve transit time TY*. It is assumed that the control valve is already open or closed, meaning further control signals do not change the valve position.

Function	WE	Configuration
Control signal deactivation	OFF	Co5 -> Fb16 = ON

8.13 Processing of external demand

The controller (= primary controller) is able to process analog signals for demand.
The external flow temperature set point of the preceding controller is received over the analog input AE1. 0 to 10 V corresponds to 0 to 120 °C. Demands under a signal of 1 V are suppressed. The received flow temperature set point is compared to the controller's own flow temperature set point. The higher of both flow temperature set points plus the *Boost* parameter is used for the control.
The *Boost* parameter improves the control characteristic of the downstream control valves in the heating circuit and compensates for any pipeline losses.

Function	WE	Configuration
External demand	OFF	Co5 -> Fb15 = ON
	0 °C	Boost / 0 to 30 °C

8.14 Feedforwarding the outdoor temperature

The outdoor temperature can be passed on to another controller over the analog output AA2 (0 to 10 V) by setting Co2 -> Fb05 = ON, provided this output is not used for a control signal or for the modulation control.

Systems Anl 1 to 3:
The outdoor temperature is constantly applied to AA2. No special settings are necessary. 0 to 10 V corresponds to –40 to 50 °C.

Systems Anl 4 to 6:

Function	WE	Configuration
Continuous RüL-RK2	OFF	Co2 -> Fb05 = OFF

System Anl 7:
The outdoor temperature cannot be passed on as the output AA2 is constantly used for a control signal or for the modulation control.

8.15 Locking of changed settings

An active locking of all manual levels means that no settings (configuration and parameterization) can be performed at the controller.

Function	WE	Configuration
Configuration and parameterization protection	OFF	Co5 -> Fb04 = ON

9 Operational faults

Operational faults are indicated by the ! icon blinking on the display.

"Error" immediately appears on the display. Press ⊠ to access the error level. Use the arrow keys to scroll the different error alarms, if need be. The error level remains in the display loop as long as an acute operational fault exist even if it has not be opened by pressing ⊠.

9.1 Error list

- Err 1 Sensor failure in RK1 (in combination with sensor icons)
- Err 2 Sensor failure in RK2 (in combination with sensor icons)
- Err 3 Sensor failure in heating circuit (in combination with sensor icon)
- Err 4 Sensor failure in DHW circuit (in combination with sensor icons)
- Err 5 Failure of sensor VFg, RüFg or AF (in combination with sensor icons)
- Err b1 Fault in Boiler K1
- Err b2 Fault in Boiler K2
- Err P1 Fault in Pump Pu1
- Err P2 Fault in Pump Pu2
- Err-1 Default values read (default settings)
- Err-2 Final temperature of thermal disinfection not achieved
- Err-3 Mode selector switch 1 defective
- Err-4 Selector switch defective
- Err-5 Correction switch for the flow temperature defective

9.2 Sensor failure

The error list explains how the "Err-1" to "Err-5" on the display in the error level indicate sensor failures. After exiting the error level, detailed information can be found within the operating level by reading each temperature: A sensor icon in combination with three dashes instead of the measured temperature on the display indicates that this sensor is defective.

Sensor icons


Outdoor sensor AF


Flow sensor VF2, VFg,
Boiler sensor KF1, KF2


Return flow sensor RüF1, RüF2, RüFg


Room sensor RF


Storage tank sensor SF1


Storage tank sensor SF2

The following list shows how the controller reacts depending on which sensor fails:

- **Outdoor sensor AF**: When the outdoor sensor fails, the controller uses a flow temperature set point of 70 °C. The boiler pumps are switched on and the control valves of the return flow boost are opened to ensure frost protection.
- **Flow sensor VFg**: Both boilers are switched off immediately.
- **Flow sensor VF1, VF2**: The affected boiler is switched off. The other boiler takes over.
- **Return flow sensor RüFg**: The controller continues to function without the differential temperature control using variable weighting factors.
- **Boiler return flow sensor RüF**: The controller continues to function without the return temperature limitation. If the affected boiler is switched on, the boiler pump is switched on and the control valve receives a constant signal.
- **Storage tank sensor SF1/SF 2**: When one of the sensors fail, storage tank charging no longer takes place.
- **Boiler K1, K2 (binary inputs SM_K):** The affected boiler and the associated pump are stopped.
- **Pumps (binary inputs SM_P):** The affected boiler and the associated pump are stopped.

9.3 Displaying the lead/collective error alarm

The lead is indicated over BA2 when the function block is active:

- Lead 1: BA2 = OFF
- Lead 2: BA2 = ON

The binary output BA2 is set in the event of an error when the function block is not active. Errors are still displayed by "Err" in the info level.

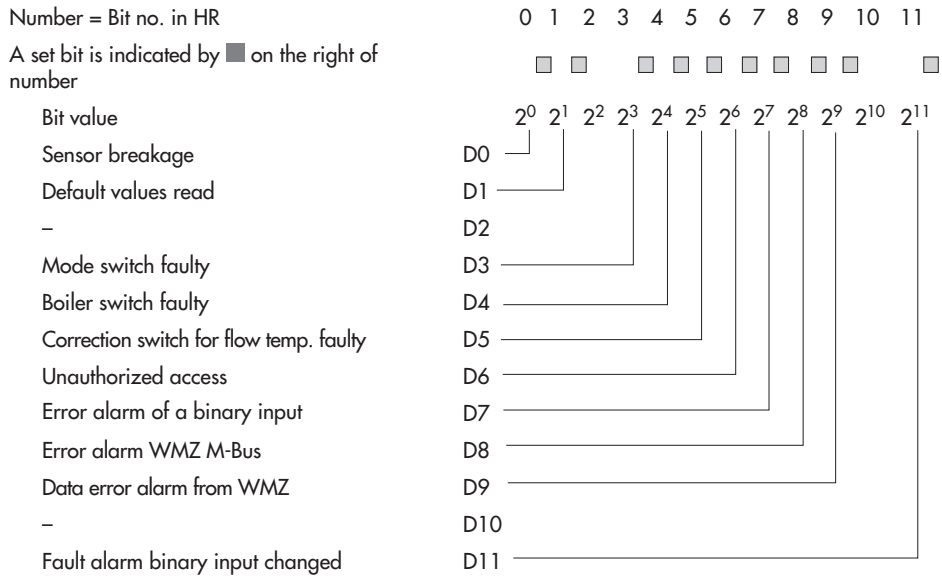
Function	WE	Configuration
Displaying lead/collective alarm	OFF	Co5 -> Fb11

9.4 Error status register

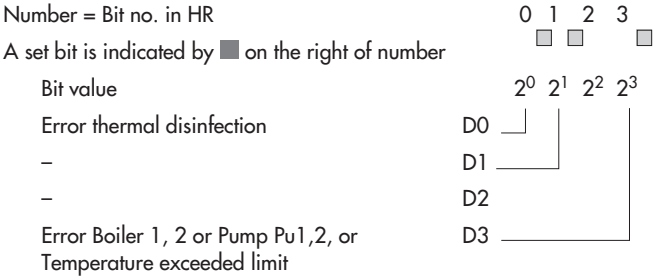
The error status register is used to indicate controller or system errors. In modem operation with *Dial-up also upon corrected fault* function, any change in state of the error status register causes the building control station to be dialed.

The error status registers are displayed in InF8 level. By default the error status register FSR1 (holding register 60) is displayed. Keep ⊠ pressed to display FSR2 (holding register 61). In both displays, function blocks Fb20 to Fb23 are set when a bit is set in the error status register not being displayed.

Holding register 60 (HR60)



Holding register 61 (HR61)



Example of a transfer to the control system:
The error status register is transferred as a word <w> in a holding register (HR) whose content is represented by the total of the value <z> of the active data bit:
<w> = ([D0] x <1> + [D1] x <2>) + … + ([D11] x <2048>)

9.5 Error alarms

Error alarms can be sent over a modem either directly to the control station or over the SMS text message function to a mobile phone or to a fax. Just one function (Modbus, SMS function or fax function) can be selected at one time since the functions use the same interface.
The error alarms to a mobile phone and to a fax contain the number of the affected error status register (FSR1/FSR2), the fault as per error status register (BitNo), the controller ID and the bit number (Bit xx).

9.5.1 Sending text message in case of error

Currently, text messages can only be sent to the German D1 network. The corresponding access numbers into the D1 network as well as the mobile phone number of the recipient must be set in the PA9 level:

- **D1 access number:** 0171 252 10 02
  (add 0 in front when dialing from a private branch exchange)
  Digits 0 to 9, P = pause, - = end, max. 22 characters
  The access number is assigned by Deutsche Telekom and may alter.
- **Mobile phone number:** 49 xxx yyyyyyy , where xxx stands for 160, 171 or any other valid D1 dialing code and yyyyyy represents the specific phone number of the mobile phone you wish the alarm to be sent to.
  Digits 0 to 9, P = pause, - = end, max. 14 characters

Note!
Currently, text messages can only be sent to the German D1 network.

Functions	WE	Configuration
Modbus	ON	Co9 -> Fb00 = OFF
Modem function	OFF	Co9 -> Fb01 = OFF
Text message alarm to a mobile phone	OFF	Co9 -> Fb06 = ON
SMS dialing procedure	OFF	Co9 -> Fb07
Alarm sent per fax	OFF	Co9 -> Fb10 = OFF

Parameters	WE	Parameter level / Range of values
Access number	–	PA9 / configurable as required*
Phone number	–	PA9 / configurable as required**

* Digits 0 to 9, P = pause, - = end, max. 14 characters

** Digits 0 to 9, P = pause, - = end, max. 22 characters

9.5.2 Sending fax in case of a fault alarm

The controller type is forwarded in addition to a detailed error description. The recipient's fax number must be programmed in the PA9 level. Optionally, also the sender's station ID can be programmed; this number will then be forwarded as well. If no station ID is specified, the string "nicht verfügbar" (not available) is inserted.

- **Fax number:**
  Digits 0 to 9, P = Pause, - = End, max. 14 characters
  (place an additional 0 in front when dialing from a private branch exchange)
- **Phone number of sending fax:**
  Digits 0 to 9, P = Pause, - = End, max. 14 characters

Functions	WE	Configuration
Modbus	ON	Co9 -> Fb00 = OFF
Modem function	OFF	Co9 -> Fb01 = OFF
Text message alarm to a mobile phone	OFF	Co9 -> Fb06 = OFF
Alarm sent per fax	OFF	Co9 -> Fb10 = ON
Fax dialing procedure	OFF	Co9 -> Fb11

Parameters	WE	Parameter level / Range of values
Fax number	–	PA9 / configurable as required*
Phone number of sending controller	–	PA9 / configurable as required*

* Digits 0 to 9, P = pause, - = end, max. 14 characters

10 Communication

Using the serial system bus interface RS-232-C, the TROVIS 5474 Boiler Controller can communicate with a building control system. In combination with a suitable software for process visualization and communication, a complete control system can be implemented.

The following communication settings are possible:

– Operation with a dial-up modem at the RS-232-C system bus interface
Basically, communication is only established automatically when errors occur. The controller works autonomously. Nevertheless, the modem can dial up to the controller at any time to read data from it or otherwise influence it, if necessary. We recommend to use the modem connecting cable (1400-7139).

– **Operation with a leased line modem at the RS-232-C system bus interface**
Communication is established via a permanent connection between two leased line modems. This setup is applied for long-distance transmissions or when different signal level converters are used. The connection between controller and modem can also be established via the modem connecting cable (1400-7139).

– **Operation at a four-wire or two-wire bus**
To establish the link between controller and bus line, the signal level needs to be converted by a converter (SAMSON's cable converter 1400-7308).

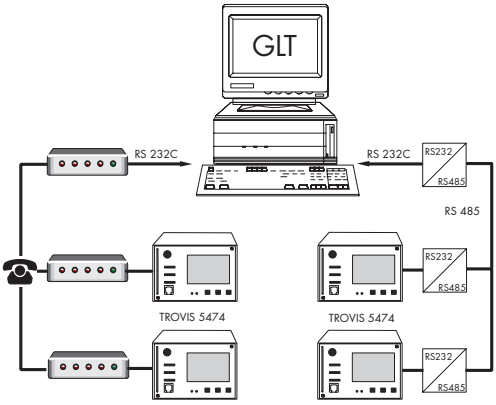


Fig. 7 · Network structure

10.1 Controller with RS-232 port

The system bus connection is located at the back of the controller housing (RJ-12 jack).
In this case, the controller can be connected either directly to the serial interface of a PC (point-to-point connection) or to a (dial-up) modem. A dial-up modem is required if the controller is to be connected to the telecommunications network. In this case, the controller works autonomously and can issue an alarm call to the building control station when errors occur. Additionally, the building control station can dial up the controller, read data from it, and send new data once the valid key number has been written to the holding register no. 40070.
On recognizing the key code from the controller as valid, the register value "1" confirms writing permission. In any other case, the register value remains at "0". Any further establishment of communications requires the writing permission to be acquired by resending the key number.

Note!
If a wrong key number has been written to holding register no. 40070 for the third consecutive time, the controller immediately interrupts the modem connection and sets the D6 bit of the error status register (Unauthorized access). As a result, the call to the configured control system is triggered and a text message/fax sent. Bit D6 is deleted as soon as the error status register has been read by the control system and the connection has been terminated.

In special cases, the **Lock dial-up** function can be selected to stop dial-up in case an error occurs. Using the **Dial-up also upon corrected error** function, the controller additionally informs the building control station when a previously signaled error no longer persists.

Functions	WE	Configuration
Modbus	ON	Co9 -> Fb00 = ON
Modem function	OFF	Co9 -> Fb01 = ON
Modem dialing procedure	OFF	Co9 -> Fb02
Lock dial-up	OFF	Co9 -> Fb03
Modbus 16-bit addressing	OFF	Co9 -> Fb04
Dial-up also upon corrected fault	OFF	Co9 -> Fb00
Parameters*	WE	Parameter level / Range of values
Station address (ST.-NR)	255	PA9 / 1 to 247 (with Fb04 = ON: 1 to 999)
Baud rate (BAUD)	9600	PA9 / 300 to 19200
Cyclic initialization (I)	30 min	PA9 / 0 to 255 min
Modem dial interval between calls (P)	5 min	PA9 / 1 to 255 min

Parameters*	WE	Parameter level / Range of values
Modem timeout (t)	5 min	PA9 / 1 to 255 min
Number of redial attempts (C)	5	PA9 / 0 to 99
Phone number of building control station (tELno)	–	PA9 / Set as required**
Phone number of alternative recipient (rESno)	–	PA9 / Set as required**

** Digits 0 to 9, P = Pause, - = End, max. 23 characters

* –> Section 10.3 (“Description of communication parameters to be adjusted”)

10.2 System bus interface in conjunction with cable converters RS-232/RS-485 (for four-wire bus)

A constant bus connection is required (data cable) for the operation of the controller with serial RS-485 interface. The bus line links the control units/devices in an open ring. At the end of the bus line, the data cable is connected to the control station using an RS-485/RS-232 converter (e.g. TROVIS 5484).
The maximum range of the bus connection (cable length) is 1,200 meters. A maximum of 32 devices can be connected to such a segment.

If you wish to use more than 32 devices in line or need to bridge greater distances, make sure repeaters (e.g. TROVIS 5482) are installed to replicate the signal. With 8-bit addressing, a maximum of 246 devices can be addressed and connected to a bus.

⚠ ***Warning!***
You are required to follow the relevant standards and regulations concerning lightning and overvoltage protection on installation.

Functions	WE	Configuration
Modbus	ON	Co9 -> Fb00 = ON
Modem function	OFF	Co9 -> Fb01 = OFF
Modbus 16-bit addressing	OFF	Co9 -> Fb04

Parameters*	WE	Parameter level / Range of values
Station address (ST.-NR)	255	PA9 / 1 to 247 (with Fb04 = ON: 1 to 999)
Baud rate	9600	PA9 / 300 to 19200

* –> Section 10.3 (”Description of communication parameters to be adjusted”)

10.3 Description of communication parameters to be adjusted

Station address (ST.-NR)
This address is used to identify the controller in bus or modem mode. In a system, each controller needs to be assigned a unique address.

Baud rate (BAUD)
In a bus system, baud rate refers to the transfer speed between control system and controller. In modem mode, baud rate refers to the transfer speed between controller and modem.
The baud rate adjusted at the controller must correspond with the baud rate of the control system, otherwise no communication can be established.

Cyclical initialization (I)
This parameter defines the period of time for a cyclical issue of the initialization command "ATZ". The command is not issued during dial-up or when connected. "ATZ" causes the profile 0 to be copied to the active profile, provided the modem parameters have been set and saved in profile 0 using a suitable terminal program.

Typical initialization of a modem with a terminal program:
AT & F (restores modem to its factory settings)
OK (response of the modem)
ATEOSO = 1 (command input, EO: echo off;
SO = 1: answer on first ring)

Dialing pause (P)
It is recommendable to pause for approx. 3 to 5 minutes between dialing up to the control system to avoid a permanent overloading of the telecommunications network. The *Dialing pause* defines the interval between 2 dialing attempts.

Modem time-out (t)
When the controller connects to the control station but without addressing a Modbus data point, the connection is closed after the time specified for *Modem time-out* has elapsed. If the error status register has not been read during the control station connection, the controller dials up to the control station again after the *Dialing pause* (P) has elapsed.

Number of redialing attempts (C)
The controller tries to dial up to the control system again, observing the *Dialing pause*, in case the control station is busy or the function that triggered the call has not been reset by the controller. After the specified number of redialing attempts have failed, the controller dials the alternative recipient.

Reset the function that triggered the call = Polling the error status register (HR 40060)

Phone number of control station (tElno)
Enter the phone number of the control system modem including the dialing code, if necessary. Short pauses between the numbers can be entered using P (= 1 second); the end of the string is to be marked by "–". The phone number may include a maximum of 22 characters.
Example: "069, 2 sec. pause, 4009, 1 sec. pause, 0": 0 6 9 P P 4 0 0 9 P 0 – (= 11 characters)

Phone number of alternative recipient (rESno)
Enter the phone number of an alternative recipient, if required including the dialing code. Short pauses between the numbers can be entered using P (= 1 second); "–" indicates the end of the string. The phone number can include max. 22 characters.
Example: "069, 1 sec. pause, 654321": 0 6 9 P 6 5 4 3 2 1 – (= 10 characters)

Common modem settings are:

- EO - Echo off
- QO - Enable result codes
- X3 - Dial without checking for dial tone
- % CO - Data compression off
- \ N1 - Buffer off, fault correction off
- V1 - Result codes in text format
- % B 9600 - Baud rate 9600
- \ VO - Standard connect result code

Resetting to default settings
A modem can be reset to its default settings directly at the controller after entering the key number.

Key number	Command
44	AT&F&W <CR> <LF>
45	AT&F&W ATX3 <CR> <LF> (for branch exchange systems)

Note!
The initialization settings described here are indispensable for operation on a dial-up modem. Nevertheless, it cannot be guaranteed that data are transferred after the initialization settings have been adjusted. Due to the broad range of modems available on the market and the different commands, refer to the operating manual of the modem for further details.

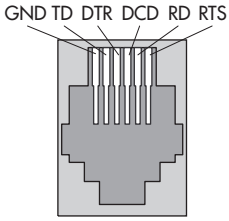


Fig. 8 · Pin assignment of RJ-12 jack

10.4 Meter bus interface

The TROVIS 5474 Controller can communicate with up to 3 heat and water meters according to EN 1434-3.
Details on the use of the different heat or water meters can be found in the technical documentation TV-SK 6311.

10.4.1 Activating the meter bus

To successfully transfer data from the heat meter (WMZ) to the controller, the heat meter must use a standardized protocol in accordance with EN 1434-3. It is impossible to make a general statement about which specific data can be accessed in each meter. For details on the different meter makes, refer to the technical documentation TV-SK 6311.

All necessary function block parameters to set up communication with heat or water meters are available in Co9 -> Fb21 to Fb23. The meter bus address, the model code, and the reading mode must be specified. A meter bus address must be unique and correspond with the address preset in the heat meter.
If the preset meter bus address is unknown, a single heat meter connected to the controller can be assigned meter bus address 254. Address 255 deactivates communication with the respective heat meter. The model code, which needs to be set for the respective heat meter, can be found in TV-SK 6311.
In general, the default setting of 1434 can be used for most devices.

The meters can be read either automatically approx. every 24 hours (24h), continuously (con) or when the coils (= Modbus data points) assigned to the heat meters WMZ1 to WMZ3 are written with the value 1 over the system bus interface (CoiL).

In InF9 info level, "1434" is displayed when the meter bus is activated. Press the enter key to get to the display referring to the meter bus. For each of the three heat meters whose address is not 255, "buSi" (with i = 1, 2, 3) appears. Press the enter key again to display the following information about the associated heat meter:

- Flow rate (d, cm/h)
- Volume (U, cm^3)
- Output capacity (P, kW)
- Energy (A, Mwh, GJ)
- Flow temperature (b, °C)
- Return flow temperature (b, °C)
- Meter ID number (L without enter key, H with enter key)
- Meter bus address (sent by WMZ) (A, –)

Blinking values in combination with black squares in the top row of the display (fault status of the associated meter –> TV-SK 6311) indicate different faults.

Note!

With reading mode "24h", the displayed values are not updated by reading the status information again; the values read during the last cycle remain unchanged.

With reading mode "con, the values in the levels are not continuously updated. Reopen the specific level to get current values.

Function	WE	Configuration
Meter bus	OFF	Co9 -> Fb21 = ON, Fb22 = ON, Fb23 = ON
	255	Meter bus address for WMZ 1 to 3 / 0 to 255
	1434	Model code WMZ 1 to 3 / P15, PS2, 1434, CAL3, APAtO, SLS
	con	Reading mode WMZ 1 to 3 / 24h, con, CoiL

10.5 Memory module

The use of a memory module (accessory no. 1400-7142) is particularly useful to transfer all data from one TROVIS 5474 Controller to several other TROVIS 5474 Controllers. The memory module is plugged into the RJ-12 jack integrated into the front panel. Once the module has been connected, "74 SP" is displayed. If the memory module already contains data from a different TROVIS 5474 Controller, press the enter key until "SP 74" is displayed.

- Pressing the enter key to confirm "74 SP" causes the controller settings to be transferred to the memory module.
- Pressing the enter key to confirm "SP 74" causes the saved controller settings to be transferred from the memory module to the controller.

During the data transfer, the bars on the display indicate the progress. After the display stops, remove the memory module from the controller.

11 Installation

The controller consists of the housing with the electronics and the back panel with the terminals. It is suitable for panel, wall, and top hat rail mounting (Fig. 9).

Panel mounting

1. Remove both screws (1).
2. Pull apart the controller housing and back panel.
3. Make a cut-out of 138 x 91 mm (width x height) in the control panel.
4. Insert the controller housing through the panel cut-out.
5. Insert one mounting clamp (2) each at the top and bottom or at the sides. Screw the threaded rod towards the panel with a screwdriver such that the housing is clamped against the control panel.
6. Install the electrical connections at the back of the housing as described in section 11.
7. Fit the controller housing.
8. Fasten both screws (1).

Wall mounting

1. Remove both screws (1).
2. Pull apart the controller housing and back panel.
3. If necessary, bore holes with the specified dimensions in the appropriate places. Fasten the back panel with four screws.
4. Install the electrical connections at the back of the housing as described in section 11.
5. Fit the controller housing.
6. Fasten both screws (1).

Top hat rail mounting

1. Fasten the spring-loaded hook (4) at the bottom of the top hat rail (3).
2. Slightly push the controller upwards and pull the upper hooks (5) over the top hat rail.

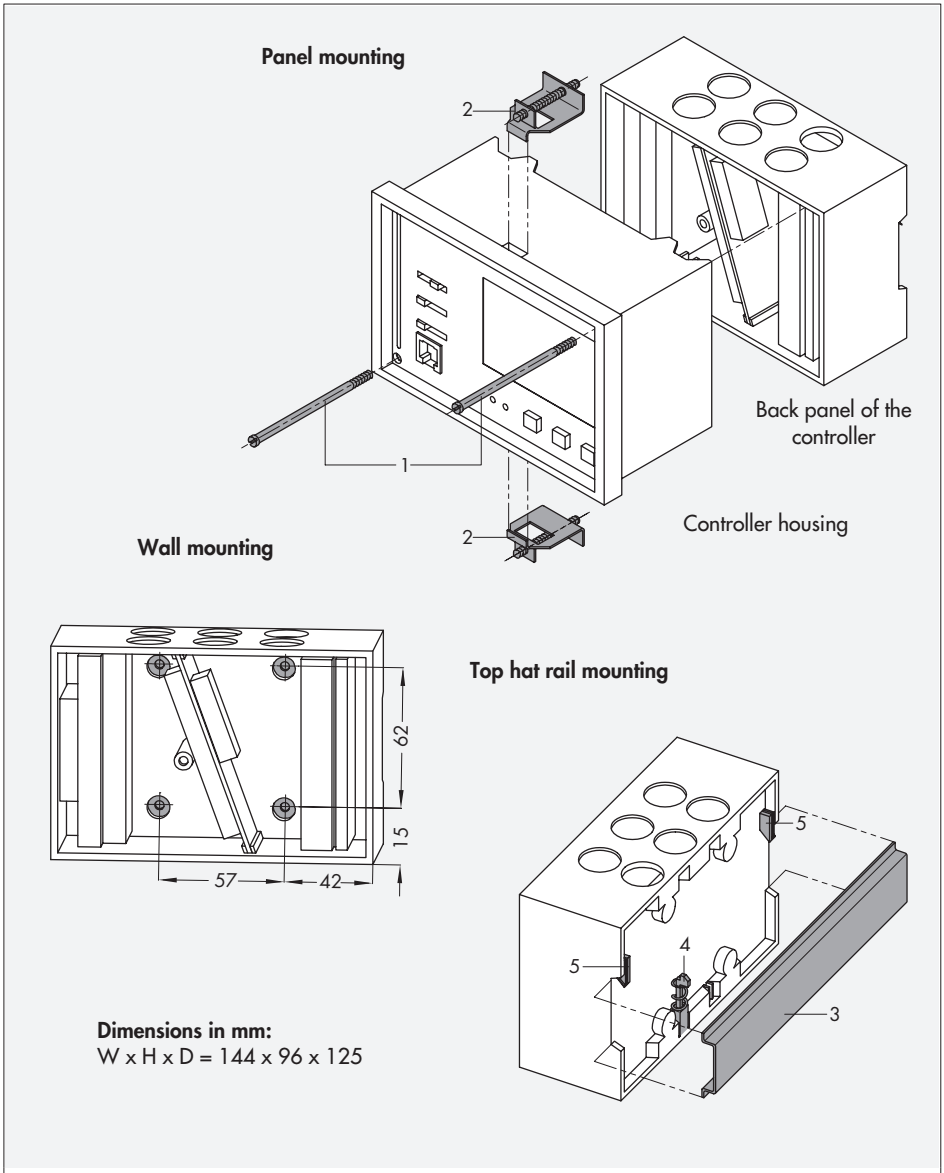


Fig. 9 · Installation

12 Electrical connection

⚠ ***Caution!***
For electrical installation, you are required to observe the relevant electrotechnical regulations of the country of use as well as the regulations of the local power suppliers. Make sure all electrical work is performed by trained and experienced personnel!

Notes on installing the electrical connections

- Install the 230 V power supply lines and the signal lines separately! To increase noise immunity, observe a minimum distance of 10 cm between the lines. Make sure the minimum distance is also observed when the lines are installed in a cabinet.
- The lines for digital signals (bus lines) and analog signals (sensor lines, analog outputs) must also be installed separately!
- In plants with a high electromagnetic noise level, we recommend to use shielded cables for the analog signal lines. Ground the shield at one side, either at the control cabinet inlet or outlet, using the largest possible cross-section. Connect the central grounding point and the PE grounding conductor with a cable ≥ 10 mm² using the shortest route.
- Inductances in the control cabinet, e.g. contactor coils, are to be equipped with suitable interference suppressors (RC elements).
- Control cabinet elements with high field strength, e.g. transformers or frequency converters, should be shielded with separators providing a good ground connection.

Overvoltage protection

- If signal lines are installed outside buildings or over large distances, make sure appropriate surge or overvoltage protection measures are taken. Such measures are indispensable for bus lines!
- The shield of signal lines installed outside buildings must have current conducting capacity and must be grounded on both sides.
- Surge diverters must be installed at the control cabinet inlet.

Connecting the controller

The controller is connected as illustrated in the following wiring diagrams.
If individual inputs for other functions, e.g. for binary input, are to be used, it must be configured in the configuration levels (Co1 to Co6).
Open the housing to connect the cables. To connect the feeding cables, make holes in the marked locations at the top, bottom or back of the rear part of the housing and fit suitable cable glands.

Connecting the sensors

Cables with a minimum cross-section of 2 x 0.5 mm² can be connected to the terminals at the back panel of the housing.

Connecting the actuators

Connect cables with at least 1.5 mm² suitable for damp locations to the terminals of the controller output. The direction of travel needs to be checked at start-up.

- Set slide switch to (+). Valves must open.
- Set slide switch to (–). Valves must close.

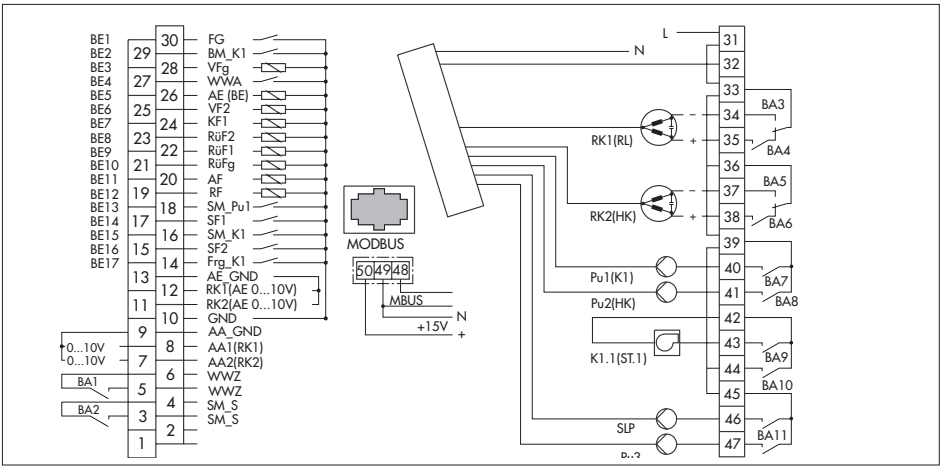
Connecting the pumps

Connect all cables with at least 1.5 mm² to the terminals of the controller as illustrated in the corresponding wiring diagram.

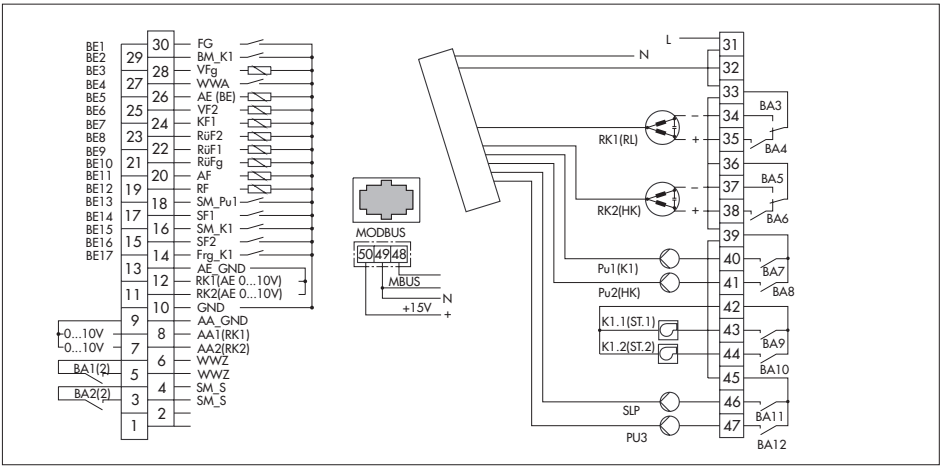
Legend for wiring plans:

AA	Analog output	RL	Return flow
AA_GND	Common analog grounding	RüF	Return flow sensor
AE	Analog input (general)	RüFg	Return flow sensor, total
AF	Outdoor temperature sensor	SF	Storage tank sensor
BA	Binary output	SG_K	Potentiometer
BE	Binary input	SLP	Storage tank charging pump
BM_K	Boiler operational fault	SM_K	Boiler fault alarm
FG	Potentiometer (valve)	SM_Pu	Pump fault alarm
Frg_K	Release boiler	SM_S	Collective fault alarm
HK	Heating circuit	St	Step of total capacity
K	Boiler	VF	Flow sensor
KF	Boiler sensor	VFg	Flow sensor, total
MBUS	Meter bus	WWA	DHW demand
Pu	Pump	WWZ	DHW forced charging
RF	Room sensor		
RK	Control circuit		

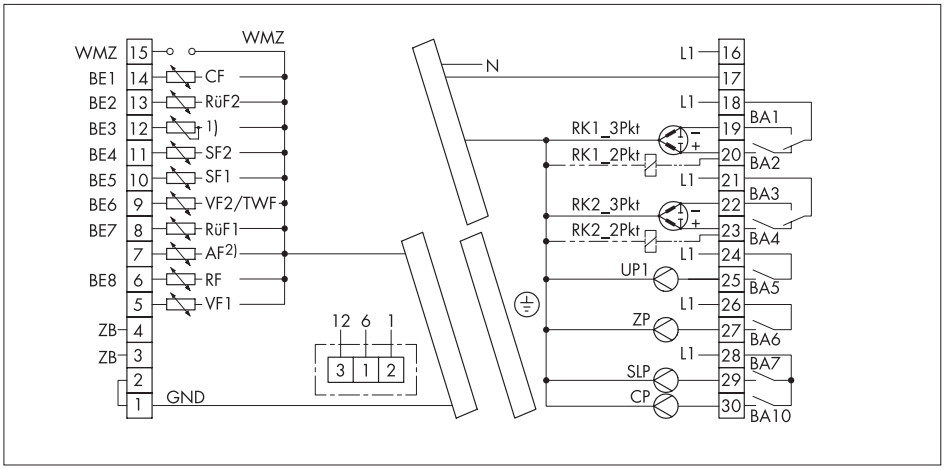
System Anl 1



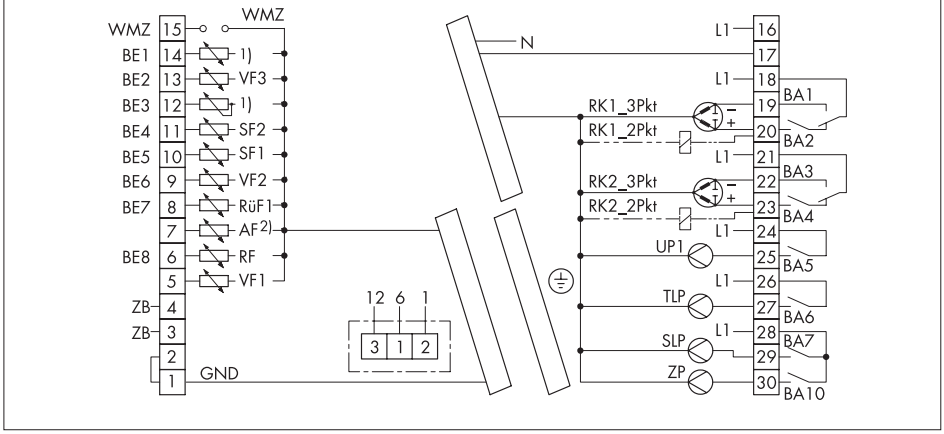
System Anl 2



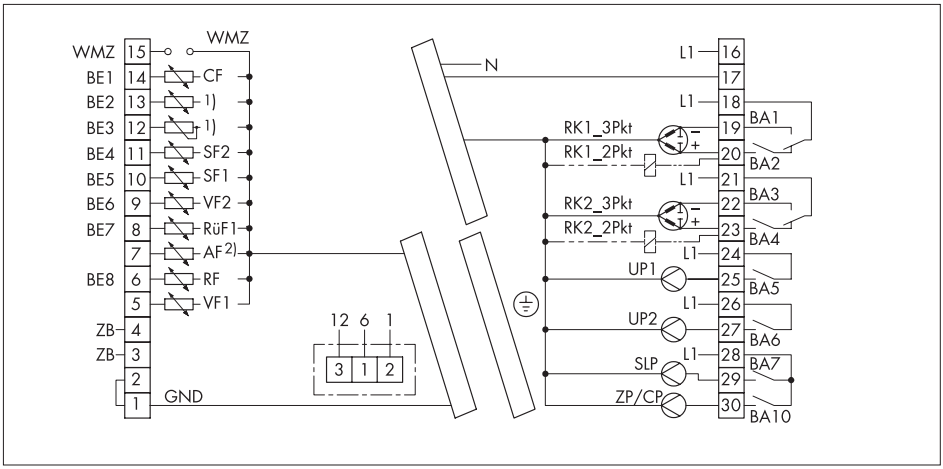
System Anl 3



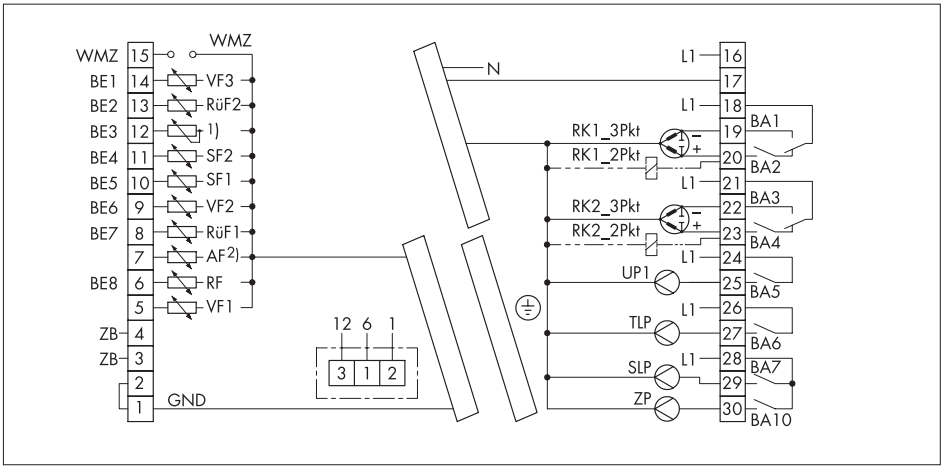
System Anl 4



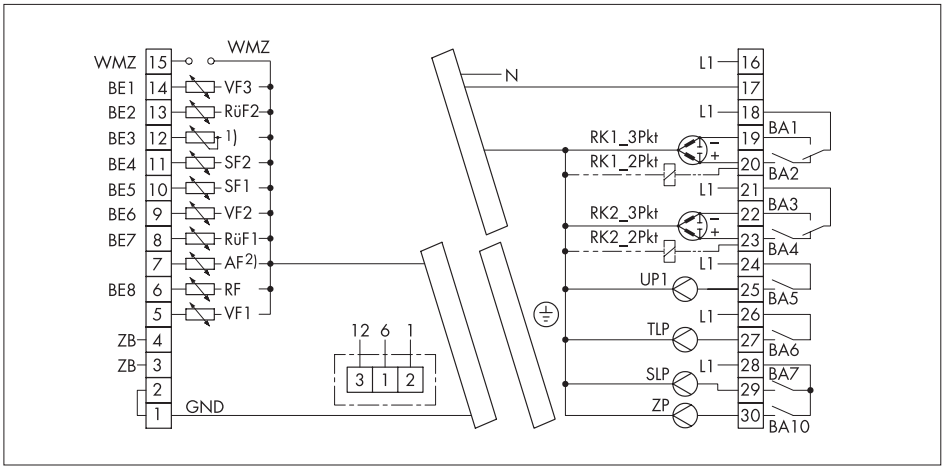
System Anl 5



System Anl 6



System Anl 7



Note!

If the terminals BE1 to BE17 are configured as 0 to 20 mA or 4 to 20 mA inputs, use terminal 13 (AE_GND) instead of terminal 10 as GND.

13 Appendix

13.1 Function block list

Co1: Boiler K1

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
00	Release of boiler K1	OFF	1 to 7	Co1 -> Fb00 = ON: Release K1 depending on position of mode selector switch and state of BE17 (Frg_K1) Co1 -> Fb00 = OFF: Release K1 only depending on position of mode selector switch
01	Operational alarm K1	ON	1 to 7	Co1 -> Fb01 = ON: Operational alarm over BE2 BM_K1 Co1 -> Fb01 = OFF: Operational alarm after start-up **Function block parameter:** Start-up time for boiler K1 / 0 to 5400 s (0 s)
02	Operating hours counter K1	OFF	1 to 7	Co1 -> Fb02 = ON: Operating hours counter active **Function block parameter:** Initial value / 0 to 99999 (0 h) **Option:** count: Counting the operating hours rESEt: Reset operating hours to initial value ***Note:*** *Can only be changed after entering the key number.*
03	Boiler sensor KF1	ON	1 to 6	Co1 -> Fb03 = ON: Monitoring with sensor Co1 -> Fb03 = OFF: Monitoring with thermostat (BE7), **Option:** StEiG: Thermostat closes FALL: Thermostat opens ***Note:*** *Cannot be deactivated in system Anl 7.*
04	Return flow sensor RüF1	ON	1 to 7	Co1 -> Fb04 = ON: Monitoring with sensor Co1 -> Fb04 = OFF: Monitoring with thermostat (BE9), **Option:** StEiG: Thermostat closes FALL: Thermostat opens
05	RüL-RK1	ON OFF	3, 6, 7 1, 2, 4, 5	Co1 -> Fb05 = ON: Return flow boost continuous control, Modulation three-step control Co1 -> Fb05 = OFF: Return flow boost three-step control Modulation continuous control, systems Anl 3, 6 and 7 only **Function block parameters:** K_P (proportional gain) / 0.1 to 99.9 (6) T_N (reset time) / 0 to 999 s (120 s) T_V (derivative-action time) / 0 to 999 s (0 s) With Co1 -> Fb05 = OFF additionally: T_Y (valve transit time) / 5 to 240 s (120 s)

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
06	Three-step pulsing/ on-off signal RüL-RK1	ON	1 to 7	Co1 -> Fb06 = ON, only with Co1 -> Fb05 = OFF: Three-step signal Co1 -> Fb06 = OFF: On-off signal **Function block parameters** Hysteresis / 1 to 30 °C (5°C) Min. activation time / 0 to 600 s (120 s) Min. deactivation time / 0 to 600 s (120 s)
07	Modulation feedback K1	ON	3, 6, 7	Co1 -> Fb07 = ON: External feedback; the actually measured resistance data are given **Function block parameters** Lower value (Start) = 0 % Modulation (0 = 1 kΩ) Upper value (Stop) = 100 % Modulation (1000 = 2 kΩ) Co1 -> Fb07 = OFF: Internal feedback **Function block parameters:** K_P (proportional gain) / 0.1 to 99.9 (2) T_N (reset time) / 0 to 999 s (30 s) T_V (derivative-action time) / 0 to 999 s (0 s) T_Y (Modulation transit time) / 5 to 240 s (30 s)* * Only when Co1 -> Fb05 = ON is also configured

Fb = Function block, WE = Default setting

Co2: Boiler K2 (systems Anl 4 to 7)

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
00	Release of boiler K2	OFF	4 to 7	Co2 -> Fb00 = ON: Release K2 depending on position of mode selector switch and state of BE16 (Frg_K2) Co2 -> Fb00 = OFF: Release K2 only depending on position of mode selector switch
01	Operational alarm K2	ON	4 to 7	Co2 -> Fb01 = ON: Operational alarm over BE1 BM_K2 Co2 -> Fb01 = OFF: Operational alarm after start-up **Function block parameter:** Start-up time for boiler K2 / 0 to 5400 s (0 s)
02	Operating hours counter K2	OFF	4 to 7	Co2 -> Fb02 = ON: Operating hours counter active **Function block parameter:** Initial value / 0 to 99999 (0 h) **Option:** count: Counting the operating hours rESEt: Reset operating hours to initial value ***Note:*** *Can only be changed after entering the key number.*
03	Boiler sensor KF2	ON	4 to 6	Co2 -> Fb03 = ON: Monitoring with sensor Co2 -> Fb03 = OFF: Monitoring with thermostat (BE6), **Option:** StEiG: Thermostat closes FALL: Thermostat opens
04	Return flow sensor RüF2	ON	4 to 7	Co2 -> Fb04 = ON: Monitoring with sensor Co2 -> Fb04 = OFF: Monitoring with thermostat (BE8), **Option:** StEiG: Thermostat closes FALL: Thermostat opens
05	RüL-RK2	OFF	4 to 7	Co2 -> Fb05 = ON: Return flow boost continuous control, Modulation three-step control Co2 -> Fb05 = OFF: Return flow boost three-step control Modulation continuous control, systems Anl 3, 6 and 7 only **Function block parameters:** K_P (proportional gain) / 0.1 to 99.9 (6) T_N (reset time) / 0 to 999 s (120 s) T_V (derivative-action time) / 0 to 999 s (0 s) With Co2 -> Fb05 = OFF additionally: T_Y (valve transit time) / 5 to 240 s (120 s)

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
06	Three-step pulsing/ on-off signal RüL-RK2	ON	4 to 7	Co2 -> Fb06 = ON, only with Co2 -> Fb05 = OFF: Three-step signal Co2 -> Fb06 = OFF: On-off signal **Function block parameters** Hysteresis / 1 to 30 °C (5°C) Min. activation time / 0 to 600 s (120 s) Min. deactivation time / 0 to 600 s (120 s)
07	Modulation feedback K2	ON	7	Co2 -> Fb07 = ON: External feedback; the actually measured resistance data are given **Function block parameters** Lower value (Start) = 0 % Modulation (0 = 1 kΩ) Upper value (Stop) = 100 % Modulation (1000 = 2 kΩ) Co1 -> Fb07 = OFF: Internal feedback **Function block parameters:** K_P (proportional gain) / 0.1 to 99.9 (2) T_N (reset time) / 0 to 999 s (30 s) T_V (derivative-action time) / 0 to 999 s (0 s) T_Y (Modulation transit time) / 5 to 240 s (30 s)* * Only when Co2 -> Fb05 = ON is also configured

Fb = Function block, WE = Default setting

Co2: Separate heating circuit (systems Anl 1 to 3)

Note!
The configuration table "Co2: Separate heating circuit" is only available in conjunction with configuration Co5 -> Fb13 = ON.

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
00	Reserved			
01	Return flow sensor RüF2	OFF	1 to 3	Co2 -> Fb01 = ON: Return flow sensor active
09	Control circuit HK2 deactivated	OFF	1 to 3	Co2 -> Fb09 = ON: HK2 = OFF
10	Type of characteristic	ON	1 to 3	Co2 -> Fb10 = ON: Weather-compensated control, **option:** 1 4-point characteristic 2 Gradient characteristic Co2 -> Fb10 = OFF: Fixed set point control
11	Summer mode	ON	1 to 3	Co2 -> Fb11 = ON: Summer mode active **Function block parameters:** START summer mode/ 01.01 to 31.12 (01.06) STOP summer mode/ 01.01 to 31.12 (30.09) Outdoor temperature limit / 0 to 40 °C (18 °C)
14	Continuous control RK2	OFF	1 to 3	Co2 -> Fb14 = ON: Continuous control **Function block parameters:** K_P (proportional gain) / 0.1 to 99.9 (6) T_N (reset time) / 0 to 999 s (120 s) T_V (derivative-action time) / 0 to 999 s (0 s)
15	Three-step pulsing/ on/off RK2	ON	1 to 3	Co2 -> Fb15 = ON: Three-step pulsing **Function block parameters:** K_P (proportional gain) / 0.1 to 99.9 (6) T_N (reset time) / 0 to 999 s (120 s) T_V (derivative-action time) / 0 to 999 s (0 s) T_Y (valve transit time) / 5 to 240 s (120 s) Co2 -> Fb15 = OFF: On/off switching

Fb = Function block, WE = Default setting

Co2: Direct heating circuit)

Note!
The configuration table "Co3: Direct heating circuit" is only available in conjunction with configuration Co5 -> Fb13 = ON.

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
00	Room sensor	OFF	1 to 3	Co3 -> Fb00 = ON: Room sensor active
05	Optimization	OFF	1 to 3	Co3 -> Fb05 = ON: **option:** 1 Activation acc. to outdoor temperature, deactivation acc. to time schedule* 2 Activation acc. to outdoor temperature, deactivation acc. to room sensor* 3 Activation and deactivation acc. to room sensor ***Function block parameter:** Advance time / 0 to 360 min (120 min)
09	Control circuit HK3 OFF	OFF	1 to 3	Co3 -> Fb09 = ON: HK2 = OFF
10	Type of characteristic	ON	1 to 3	Co3 -> Fb10 = ON: Weather-compensated control, **option:** 1 4-point characteristic 2 Gradient characteristic Co3 -> Fb10 = OFF: Fixed set point control
11	Summer mode	ON	1 to 3	Co3 -> Fb11 = ON: Summer mode active **Function block parameters:** START summer mode/ 01.01 to 31.12 (01.06) STOP summer mode/ 01.01 to 31.12 (30.09) Outdoor temperature limit / 0 to 40 °C (18 °C)
12	Potentiometer input	OFF	1 to 3	Co3 -> Fb12 = ON: Connection to room panel

Fb = Function block, WE = Default setting

Co4: DHW heating

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
00	DHW demand active	ON	1 to 7	Co4 -> Fb00 = ON: DHW set point during DHW demand Co4 -> Fb00 = OFF, only with Co5 -> Fb09 = OFF: External change in lag/lead sequence
01	Reserved			
02	DHW forced charging	OFF	1 to 7	Co4 -> Fb02 = ON: Monitoring VFg, KF1, KF2 for maximum limit f. DHW forced charging **Function block parameter:** Maximum limit f. DHW forced charging / 20 to 120 °C (80 °C)
03	Storage tank sensor SF1	OFF	1 to 3 *	Co4 -> Fb03 = ON: Storage tank sensor SF1 Co4 -> Fb03 = OFF, only with CO4 -> Fb04 = OFF: Storage tank thermostat
04	Storage tank sensor SF2	OFF	1 to 3 *	Co4 -> Fb04 = ON, only with Co4 -> Fb03 = OFF: Storage tank sensor SF2 Co4 -> Fb04 = OFF: Only storage tank sensor SF1
05	Reserved			
06	DHW priority HK2	OFF	1 to 3 *	Co4 -> Fb06 = ON: HK2 in reduced operation during storage tank charging
07	DHW priority HK3	OFF	1 to 3 *	Co4 -> Fb07 = ON: Pump Pu3 switched off during storage tank charging
08	Thermal disinfection	OFF	1 to 3 *	Co4 -> Fb08 = ON: Only if Co3 -> Fb03 = ON or Co4 -> Fb03 = ON and Co4 -> Fb04 = ON **Function block parameters:** Day of week / 0 = daily, 1 = Mon, 2 = Tue, …, 7 = Sun (3) Disinfection temperature / 50 to 80 °C (70 °C) Start time / 0:00 to 23:59 h (0:00 h) Stop time / 0:00 to 23:59 h (4:00 h)
09	Reserved			
10	Adopt vacations and public holidays for DHW heating	OFF	1 to 3 *	Co4 -> Fb10 = ON: Adopt vacations and public holidays from Co2

Fb = Function block, WE = Default setting

Co5: General functions

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
00	Outdoor sensor	ON	1 to 7	Co5 -> Fb00 = ON: **option:** FUEHL: Sensor at input AF 0-10: 0 to 10 V outdoor temperature at input AE2 **Function block parameter:** Frost protection limit / –30 to 20 °C (3 °C) Co5 -> Fb00 = OFF: Input as BE; **option:** Lead OFF (FoAUS) Frost protection BE (FroSt)
01	Delayed outdoor temperature adaptation	OFF	1 to 7	Co5 -> Fb01 = ON: Delay active; **option:** Ab: Delay on decreasing temperature AUFAB: Delay on decreasing and rising temperature **Function block parameter:** Delay / 1 to 6 °C/h (3 °C/h)
02	Return flow sensor total RüFg	ON	1 to 7	Co5 -> Fb02 = ON: Differential temperature control using variable weighting factors; **Function block parameters:** Intended temperature difference / 0 to 90 °C (10 °C) Kp factor for differential temperature control / 0 to 1 (0.5)
03	Type of characteristic	ON	1 to 7	Co5 -> Fb03 = ON: Weather-compensated control; **option:** 1: 4-point characteristic 2: Gradient characteristic Co5 -> Fb03 = OFF: Fixed set point control
04	Configuration and parameterization protection	OFF	1 to 7	Co5 -> Fb04 = ON: Locking the configuration and parameterization levels, except for Co5 -> Fb 04 ***Note:*** *Can only be changed after entering the key number.*
05	Automatic summer time/winter time changeover	ON	1 to 7	Co5 -> Fb05 = ON: Automatic summer time/winter time changeover
06	Summer mode	ON	1 to 7	Co5 -> Fb06 = ON: Summer mode active **Function block parameters:** START summer mode / 01.01 to 31.12 (01.06) STOP summer mode / 01.01 to 31.12 (30.09) Outdoor temperature limit / 0 to 40 °C (18 °C)
07	Releasing sequence	ON	4 to 7	Co5 -> Fb07 = ON: Temperature t_A for releasing sequence Co5 -> Fb07 = OFF: Unrestricted sequence
08	–		–	For internal purposes only!

Fb	Function	WE	Anl	**Function block parameter** / Range of values (default setting)
09	Automatic change in lag/lead sequence	ON	*5, 7*	Co5 -> Fb09 = ON: Change in lag/lead sequence as per setting in Co5 -> Fb10 Co5 -> Fb09 = OFF: Change in lag/lead sequence only in the event of a malfunction
10	Condition for change in lag/lead sequence	ON	*5, 7*	Co5 -> Fb10 = ON: Change in lag/lead sequence acc. to operating hours Co5 -> Fb10 = OFF: **option:** 1: Change in lag/lead sequence acc. to outdoor temperature 2: Change in lag/lead sequence acc. to capacity
11	Displaying lead/collective alarm	OFF	*5, 7*	Co5 -> Fb11 = ON: Displaying lead BA2 = 0 (Füh1), BA2 = 1 (Füh2) Co5 -> Fb11 = OFF: Displaying collective alarm with BA2
12	Common return flow boost	OFF	4 to 7	Co5 -> Fb12 = ON: RK1 as return flow boost for lead boiler
13	Heating circuit with DHW heating	OFF	1 to 3	
14	Continuous running of pumps	ON	1 to 7	Co5 -> Fb14 = ON: Continuous running of lead boiler pump **Function block parameters:** Pump lag time / 0 to 90 min (5 min) Boiler flow limit / 20 to 120 °C (55 °C)
15	External demand (AE1)	OFF	1 to 7	Co5 -> Fb15 = ON: **Function block parameter:** Boost / 0 to 30 °C (0 °C)
16	Control signal deactivation	OFF	1 to 7	Co5 -> Fb16 = ON: Control signal deactivation after 3 x T_Y
19	Parallel operation of boilers	OFF	*7*	Co5 -> Fb19 = ON: Both boilers operate in parallel regardless of the system load. The boilers are started up one after the other taking into account the delay and lockout times.
20	Burner activation not dependent on sensor VFg	OFF	4 to 7	Co5 -> Fb20 = ON: Boilers are controlled exclusively according to the boiler sensors VF1 and VF2. VFg has no affect on the control loop.

Fb = Function block, WE = Default setting

Co6: Sensor initialization

Fb	Function	WE	Anl	Comments
00	Global selection of sensors	ON		Co6 -> Fb00 = ON: Pt 100, Pt 1000 Co6 -> Fb00 = OFF: Pt 100, PTC
01 to 17	Sensor input 1 to Sensor input 17	OFF		Co6 -> Fb01 to Fb17 = ON: Select sensor: 0–20 (mA), 4–20 (mA), Pt100, Pt1000, PtC, ntC, ni200, n1000 Co6 -> Fb01 to Fb17 = OFF: Same sensor selection as in FB00
23	Sensor calibration	OFF		Co6 -> Fb23 = ON: Sensor calibration of universal inputs possible Co6 -> Fb23 = OFF: No sensor calibration

Fb = Function block, WE = Default setting

Co7: Error initialization

Fb	Function	SZ	WE	Comments
00	Reserved			
01 to 17	BE1 to BE17 in error status register	X	OFF	Co8 -> Fb01 = ON: Error alarm in error status register to Co8 -> Fb17 = ON: Error alarm in error status register **option:** STEIG: Error alarm at BE1 to BE17 = CLOSED FALL: Error alarm at BE1 to BE17 = OPEN
22	Limit monitoring		OFF	Can be configured over Modbus
23	Fault alarm binary input changed		OFF	Co8 -> Fb23 = ON: Subsequent errors are also added to the error status register HR 60 (Bit D11)

Fb = Function block, WE = Default setting, SZ = Key number

Co9: Modbus/meter bus

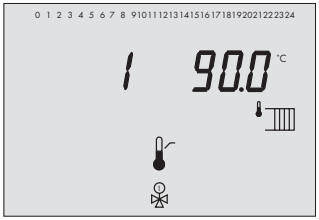
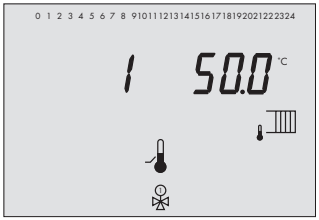
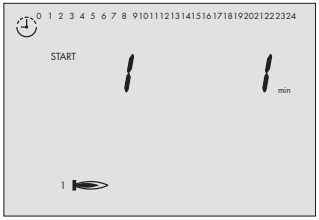
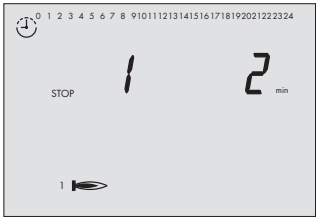
Fb	Function	SZ	WE	**Function block parameter** / Range of values (default setting)
00	Modbus		ON	Co9 -> Fb00 = ON: Modbus active only with Co9 -> Fb06 = OFF and Co9 -> Fb10 = OFF
01	Modem function		OFF	Co9 -> Fb01 = ON: Modem function active
02	Modem dialing procedure		OFF	Co9 -> Fb02 = ON: Pulse Co9 -> Fb02 = OFF: Tone
03	Lock dial-up		OFF	Co9 -> Fb03 = ON: No dial-up in case an error Co9 -> Fb03 = OFF: Dial-up in case an error
04	Modbus 16-bit addressing		OFF	Co9 -> Fb04 = ON: 16-bit addressing Co9 -> Fb04 = OFF: 8-bit addressing
05	Reserved			
06	Text message alarm to a mobile phone		OFF	Co9 -> Fb06 = ON: Text message alarm to a mobile phone only with Co9 -> Fb00 = OFF and Co9 -> Fb10 = OFF
07	SMS dialing procedure		OFF	Co9 -> Fb07 = ON: Pulse Co9 -> Fb07 = OFF: Tone
08	Reserved			
09	Reserved			
10	Alarm sent per fax		OFF	Co9 -> Fb10 = ON: Alarm sent per fax only with Co9 -> Fb00 = OFF and Co9 -> Fb06 = OFF
11	Fax dialing procedure		OFF	Co9 -> Fb11 = ON: Pulse Co9 -> Fb11 = OFF: Tone
21 to 23	Meter 1 to Meter 3		OFF	Co9 -> Fb21 = ON: Meter 1 is being processed to Co9 -> Fb23 = ON: Meter 3 is being processed **Function block parameters:** Meter bus address for WMZ / 0 to 255 (255) Model code WMZ / P15, PS2,1434, CAL3, APAtO, SLS (1434) Reading mode WMZ / 24h, con, CoiL (con)

Fb = Function block, WE = Default setting, SZ = Key number

13.2 Parameter lists

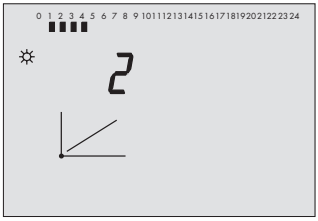
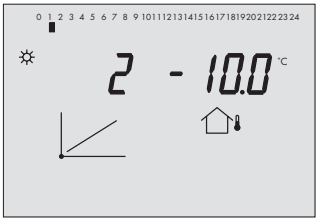
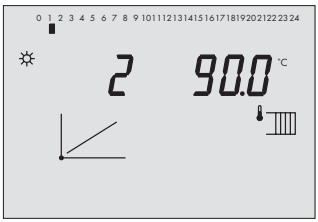
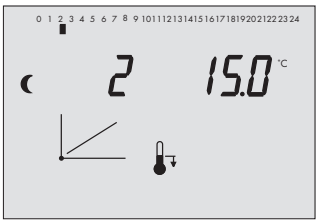
PA1: Boiler 1 (systems Anl 1 to 7)

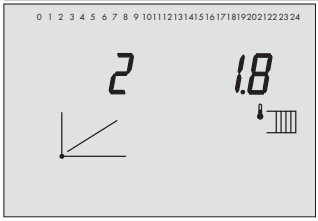
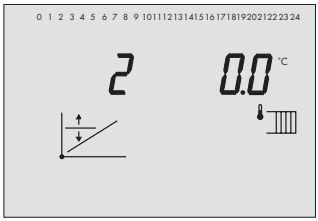
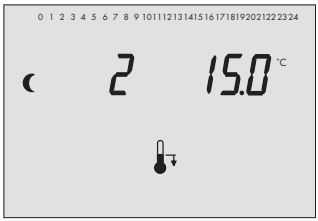
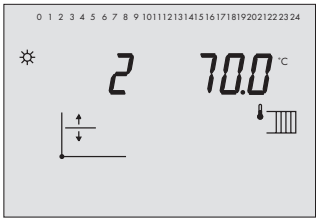
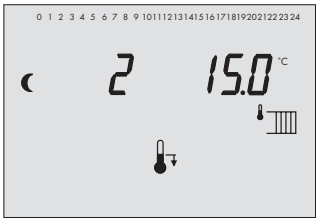
PA2: Boiler 2 (systems Anl 4 to 7)
In the PA2 parameter level, "2" appears instead of "1" on the left of the display.

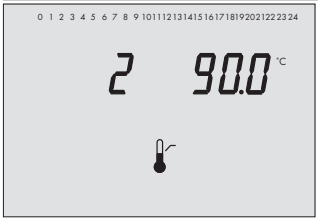
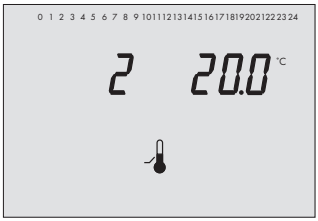
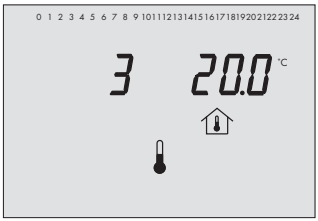
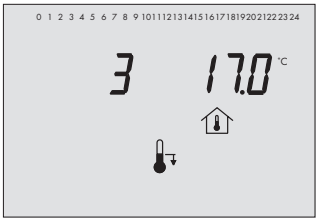
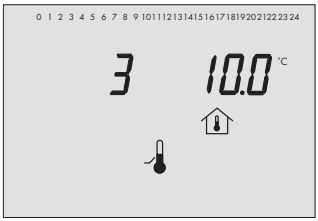
Display	Parameter designation Range of values (default setting)
	Maximum flow temperature KF1, 2 20 to 160 °C (90 °C)
	Minimum return flow temperature RüF1, 2 20 to 120 °C
	Minimum activation time for boiler K1, 2 0 to 90 min This time must have elapsed before the boiler switched off.
	Minimum deactivation time for boiler K1, 2 0 to 90 min This time must have elapsed before the boiler switched on.

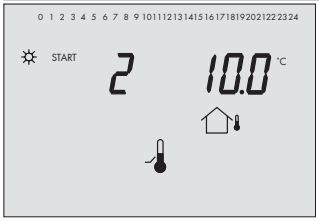
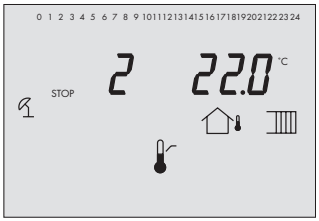
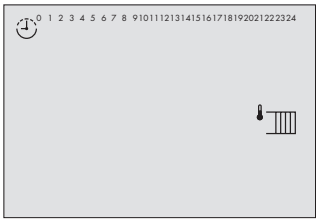
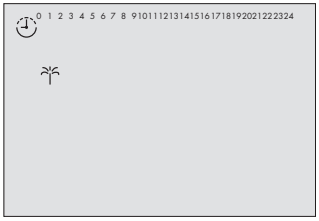
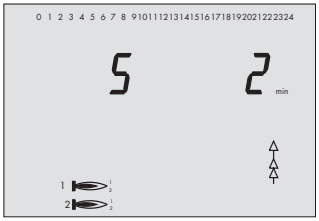
PA2: Separate heating circuit (only in systems Anl 1 to 3 with Co5 -> Fb13 = ON)

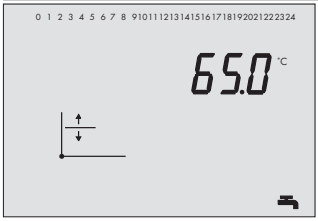
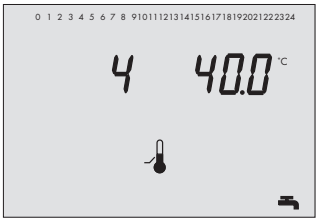
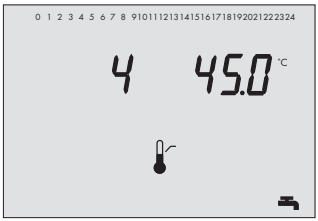
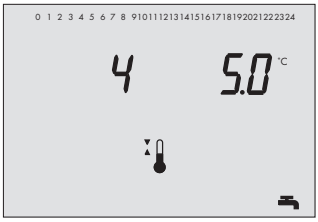
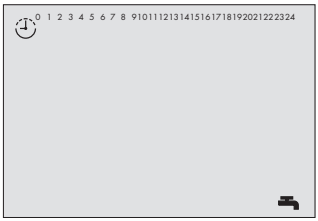
PA3: Direct heating circuit (only in systems Anl 1 to 3 with Co5 -> Fb13 = ON)
In the PA3 parameter level, "3" appears instead of "2" on the left of the display.

Display	Parameter designation Range of values (default setting)
	4-point characteristic Press to set parameters outdoor temperature (points 1 to 4) flow temperature (points 1 to 4) and set-back difference (points 2 to 3). In PA2 (PA3) only with Co2 (Co3) -> Fb10 = ON, option: 1
	4-point characteristic, point 1: Outdoor temperature Outdoor temperatures of the points 2, 3, 4 are marked by squares below the numbers 2, 3, 4. –20 to 50 °C (Point 1: –10 °C, point 2: –5 °C, point 3: 5 °C, point 4: 10 °C) In PA2 (PA3) only with Co2 (Co3) -> Fb10 = ON, option: 1
	4-point characteristic, point 1: Flow temperature Flow temperatures of the points 2, 3, 4 are marked by squares below the numbers 2, 3, 4. 20 to 160 °C (Point 1: 90 °C, point 2: 80 °C, point 3: 68 °C, point 4: 50 °C) In PA2 (PA3) only with Co2 (Co3) -> Fb10 = ON, option: 1
	4-point characteristic: Set-back difference, point 2 Set-back difference of the point 3 is marked by square below the number 3. 0 to 30 °C (Point 2: 15 °C, point 3: 20 °C) In PA2 (PA3) only with Co2 (Co3) -> Fb10 = ON, option: 1

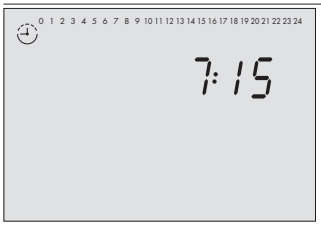
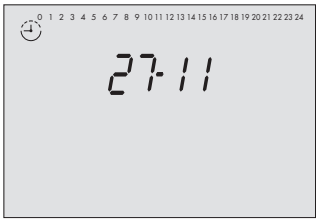
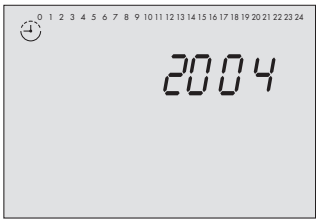
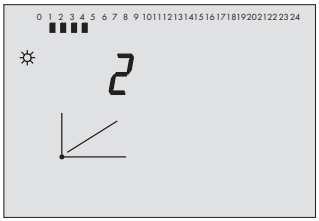
Display	**Parameter designation** Range of values (default setting)
	Gradient, flow 0.4 to 3.2 (1.8) In PA2 (PA3) only with Co2 (Co3) -> Fb10 = ON, select: 2.
	Level (parallel shift), flow –30 to 30 °C (0 °C) In PA2 (PA3) only with Co2 (Co3) -> Fb10 = ON, select: 2.
	Set-back difference 0 to 30 °C (15 °C) In PA2 (PA3) only with Co2 (Co3) -> Fb10 = ON, select: 2.
	Fixed set point control, flow temperature set point 20 to 160 °C (70 °C) In PA2 (PA3) only with Co2 (Co3) -> Fb10 = OFF
	Fixed set point control, set-back difference 0 to 30 °C (15 °C) In PA2 (PA3) only with Co2 (Co3) -> Fb10 = OFF

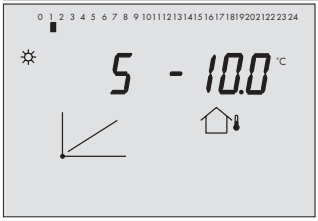
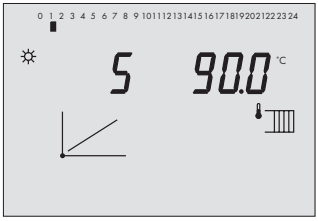
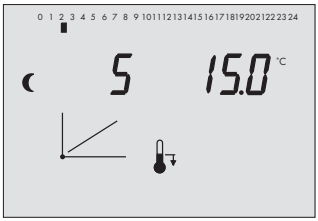
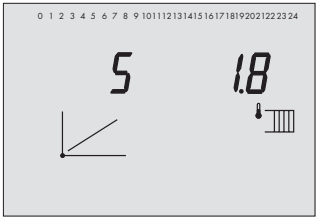
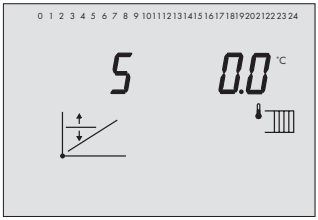
Display	Parameter designation Range of values (default setting)
	Maximum flow temperature 20 to 160 °C (90 °C)
	Minimum flow temperature 20 to 120 °C (20 °C)
	Day set point (room set point) 10 to 40 °C (20 °C) Only in PA3 with Co3 -> Fb00 = ON and Co3 -> Fb05 = ON
	Night set point (reduced room set point) 10 to 40 °C (17 °C) Only in PA3
	Sustained temperature 10 to 40 °C (10 °C) Only in PA3

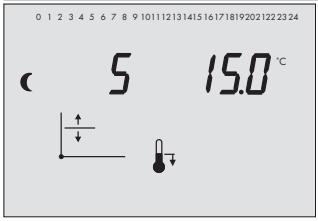
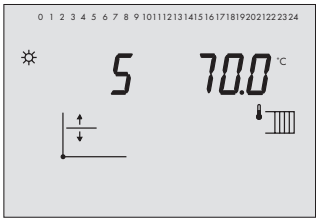
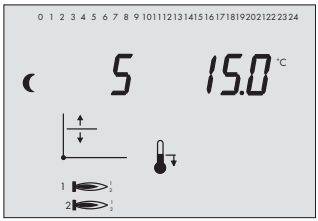
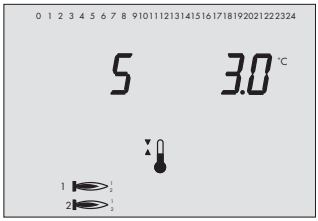
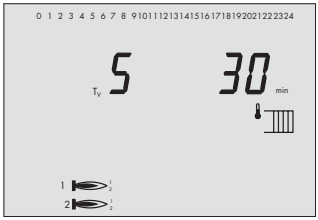
Display	Parameter designation Range of values (default setting)
	Outdoor temperature deactivation value in reduced operation –10 to 50 °C (10 °C)
	Outdoor temperature deactivation value in rated operation 0 to 50 °C (22 °C)
	Times-of-use 1–7: daily 1, 2, …, 7: Monday, Tuesday, …, Sunday
	Vacations Max. 10 vacation periods
	Public holidays Max. 20 public holidays

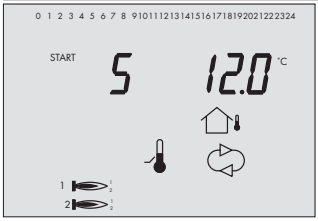
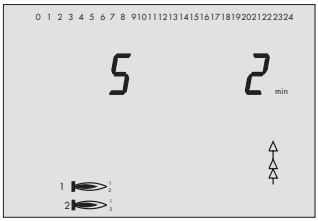
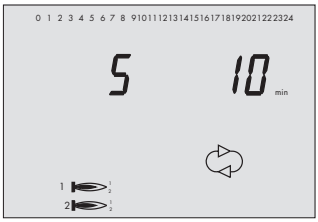
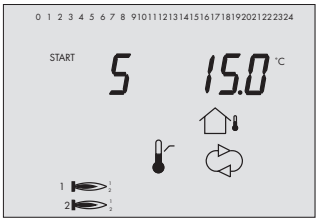
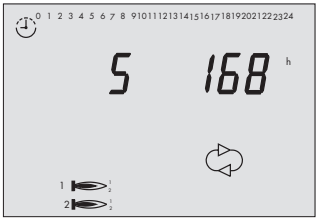
Display	Parameter designation Range of values (default setting)
	Boiler set point for DHW demand 20 to 120 °C (65 °C)
	DHW demand ON (SF1) 20 to 90 °C (40 °C)
	DHW demand OFF 20 to 90 °C (45 °C) Only with Co4 -> Fb03 = ON and Co4 -> Fb04 = ON
	Hysteresis (only if SF1 is selected) 0 to 30 °C (5 °C) Only with Co4 -> Fb03 = ON and Co4 -> Fb04 = OFF
	Times-of-use for DHW 1–7: daily 1, 2, …, 7: Monday, Tuesday, …, Sunday

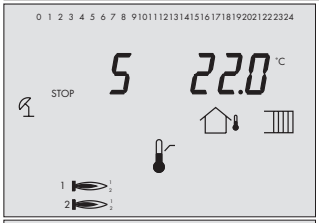
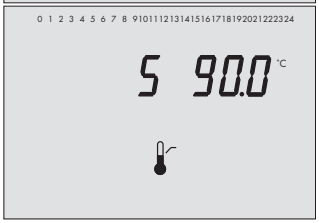
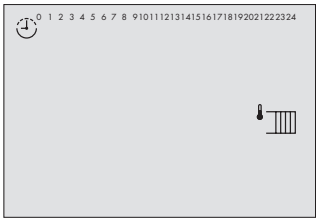
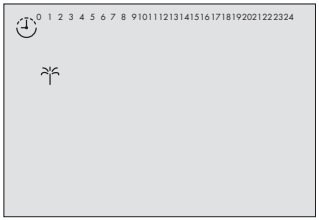
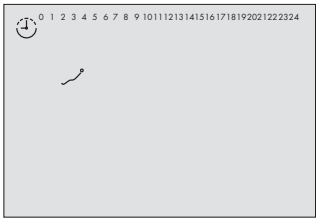
PA5: General parameters

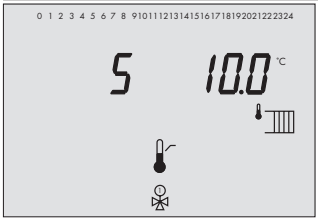
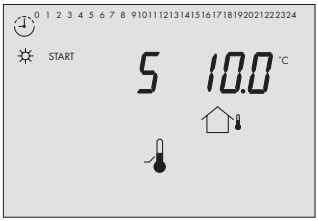
Display	Parameter designation Range of values (default setting)
	Time
	Date (Day – Month)
	Date (Year)
	4-point characteristic Press to set parameters outdoor temperature (points 1 to 4) flow temperature (points 1 to 4) and set-back difference (points 2 to 3). Only with Co5 -> Fb03 = ON, option: 1

Display	Parameter designation Range of values (default setting)
	4-point characteristic, point 1: Outdoor temperature Outdoor temperatures of the points 2, 3, 4 are marked by squares below the numbers 2, 3, 4. –20 to 50 °C (Point 1: –10 °C, point 2: –5 °C, point 3: 5 °C, point 4: 10 °C) Only with Co5 -> Fb03 = ON, option: 1
	4-point characteristic, point 1: Flow temperature Flow temperatures of the points 2, 3, 4 are marked by squares below the numbers 2, 3, 4. 20 to 160 °C (Point 1: 90 °C, point 2: 80 °C, point 3: 68 °C, point 4: 50 °C) Only with Co5 -> Fb03 = ON, option: 1
	4-point characteristic: Set-back difference, point 2 Set-back difference of the point 3 is marked by square below the number 3. 0 to 30 °C (Point 2: 15 °C, point 3: 20 °C) Only with Co5 -> Fb03 = ON, option: 1
	Gradient, flow 0.4 to 3.2 (1.8) Only with Co5 -> Fb03 = ON, option: 2
	Level (parallel shift), flow –30 to 30 °C (0 °C) Only with Co5 -> Fb03 = ON, option: 2

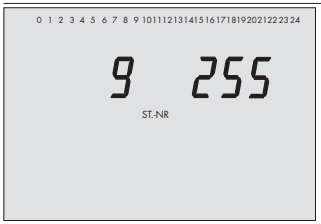
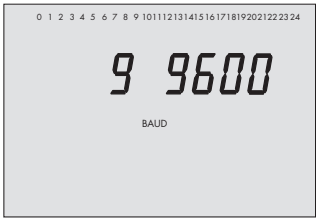
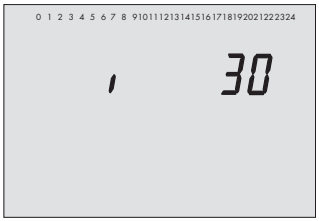
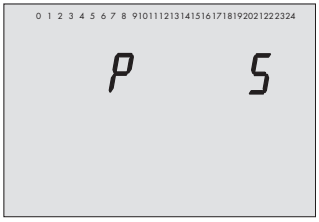
Display	Parameter designation Range of values (default setting)
	Set-back difference 0 to 30 °C (15 °C) Only with Co5 -> Fb03 = ON, option: 2
	Fixed set point control, flow temperature set point 20 to 160 °C (70 °C) Only with Co5 -> Fb03 = OFF
	Fixed set point control, set-back difference 0 to 30 °C (15 °C) Only with Co5 -> Fb03 = OFF
	Hysteresis 1 to 20 °C (3 °C)
	Tolerance time 0 to 99 min (30 min) Time in which system deviations are accepted without activation and deactivation of the lag boiler.

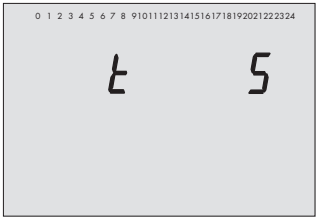
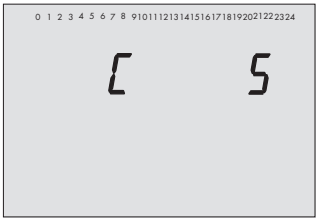
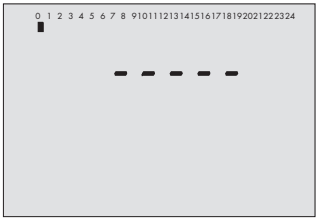
Display	Parameter designation Range of values (default setting)
	Lag boiler release temperature t_A –40 to 50 °C (12 °C) Only the lead boiler is released above this temperature.
	Lockout time 0 to 99 min (2 min) Time in which the boiler produces its maximum capacity after being switched on (temperature rises).
	Lag boiler delay 0 to 90 min (10 min) This time must elapse before the lag boiler is switched on.
	Outdoor temperature limit for lag/lead sequence change –40 to 50 °C (15 °C) Only effective when Co5 -> Fb09 = ON and Co5 -> Fb10 = OFF, option 1
	Time interval for lag/lead sequence change 0 to 999 h (168 h) Only effective when Co5 -> Fb09 = ON and Co5 -> Fb10 = ON

Display	Parameter designation Range of values (default setting)
	Outdoor temperature limit causing change to summer mode in rated operation 0 to 50 °C (22 °C)
	Maximum flow set point 20 to 160 °C (90 °C)
	Times-of-use of heating 1–7: daily 1, 2, …, 7: Monday, Tuesday, …, Sunday
	Vacations Max. 10 vacation periods
	Public holidays Max. 20 public holidays

Display	Parameter designation Range of values (default setting)
	Temperature boost 0 to 30 °C (10 °C)
	Outdoor temperature limit causing change to summer mode in reduced operation –10 to 50 °C (10 °C)

PA9: Modbus and meter bus communication

Display	Parameter designation
	Station address (ST-NR) 1 to 247 (255) (1 to 999 with Co9 -> Fb04 = ON) Only with Co9 -> Fb00 = ON
	Baud rate (BAUD) 19200, 9600, 4800, 2400, 1200, 600, 300 bit/s (9600 bit/s) Only with Co9 -> Fb00 = ON
	Cyclic initialization (I) 0 to 255 min (30 min) Only with Co9 -> Fb01 = ON
	Modem dial interval between calls (P) 1 to 255 min (5 min) Only with Co9 -> Fb01 = ON

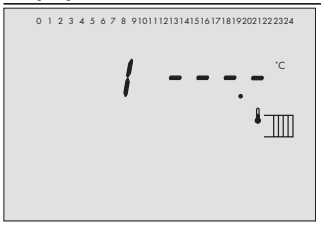
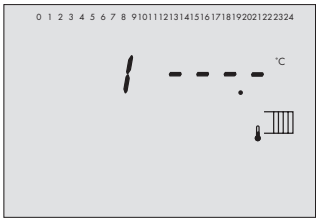
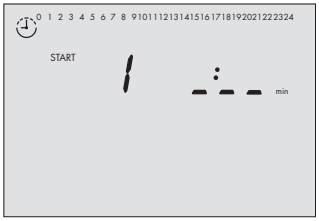
Display	Parameter designation
	Modem timeout (t) 1 to 255 min (5 min) Only with Co9 -> Fb01 = ON
	Number of redial attempts (C) 0 to 99 (5) Only with Co9 -> Fb01 = ON
	**Co9 -> Fb01 = ON**: Phone number of building control station/ Phone number of alternative recipient **Co9 -> Fb06 = ON**: D1 access number/Mobile phone number **Co9 -> Fb10 = ON**: Fax number/Phone number of sending fax Max. 22 or 14 characters: 0 to 9, P = pause, - = end of number

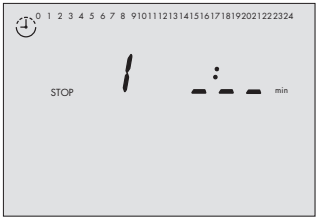
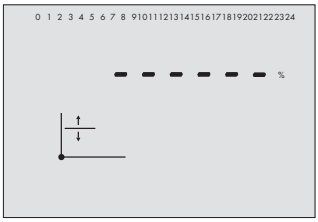
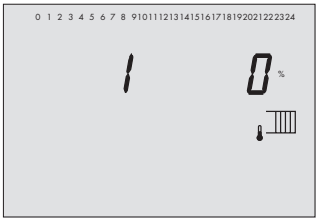
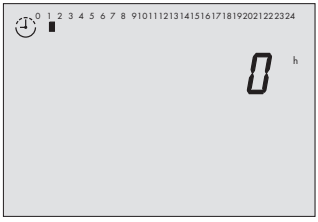
13.3 Displays

The following displays are typical displays that can appear.
Icons at the edge of the display may vary depending on the operating mode and how the controller is configured; they cannot be shown in this case.

InF1: Boiler 1 (systems Anl 1 to 7)

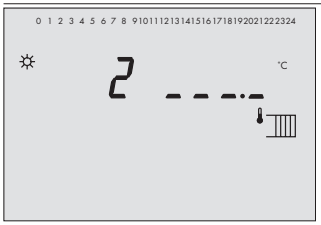
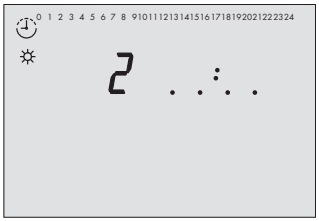
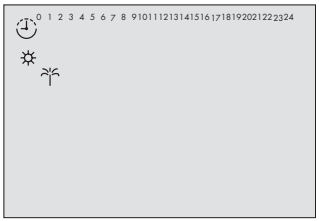
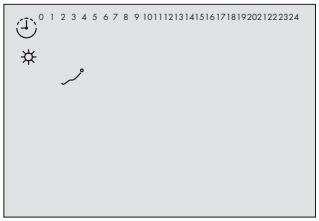
InF2: Boiler 2 (systems Anl 4 to 7)
In InF2 level, "2" appears on the left of the display instead of "1".

Display	Parameter designation
	Flow temperature, boiler ½ (KF1/2)
	Return flow temperature, boiler ½ (RüF1/2)
	Time since boiler ½ was switched on

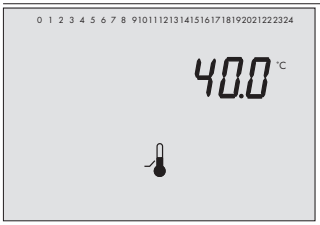
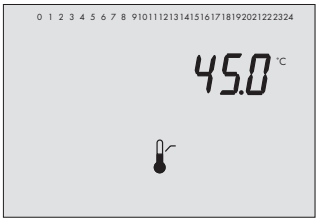
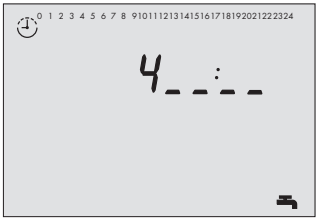
Display	Parameter designation
	Time since boiler 1/2 was switched off
	Modulation feedback
	Continuous return flow control
	Operating hours counter for boiler 1/2

InF2: Separate heating circuit (only systems Anl 1 to 3 with Co5 -> Fb13 = ON)

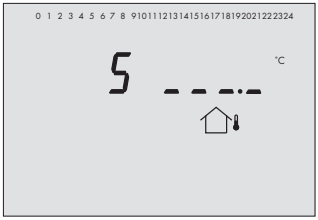
InF3: Direct heating circuit (only systems Anl 1 to 3 with Co5 -> Fb13 = ON)

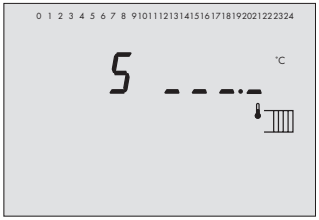
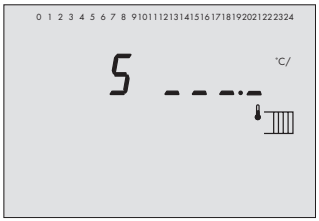
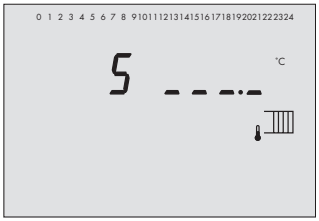
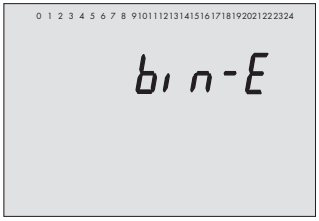
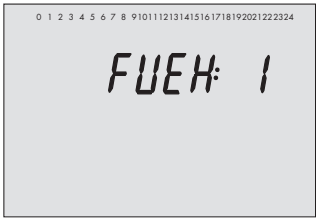
Display	Parameter designation
	Flow temperature VF2 (PA2) / VFg (PA3)
	Time Press to enter key. Display: Times-of-use for Monday (1) to Sunday (7)
	Vacations Press to enter key. Display: Dates when vacation starts and ends
	Public holidays Press to enter key. Display: Dates of programmed public holidays

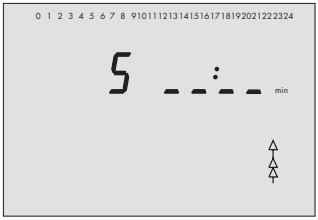
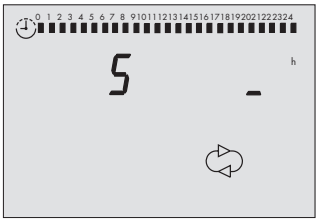
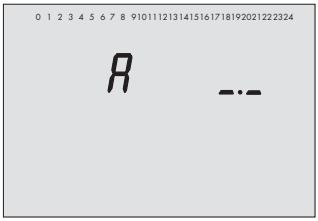
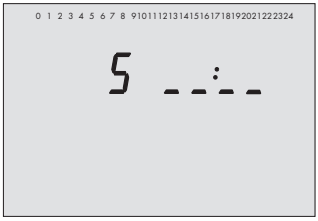
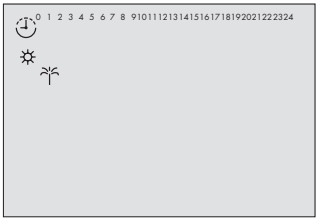
InF4: DHW heating

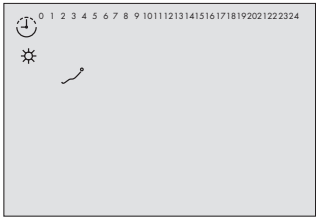
Display	Parameter designation
	Temperature at storage tank sensor SF1
	Temperature at storage tank sensor SF2
	Time of times-of-use ✳ Press to enter key. Display: Times-of-use for Monday (1) to Sunday (7)

InF5: General parameters

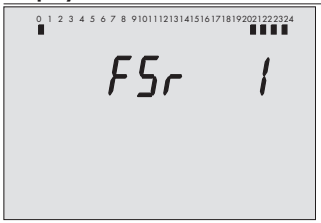
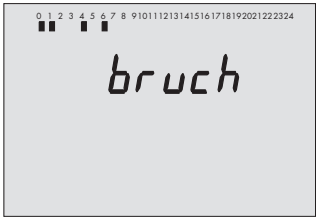
Display	Parameter designation
	Outdoor temperature (AF) ✳ Press to enter key. Display: Calculated outdoor temperature (outdoor temperature adaptation)

Display	Parameter designation
	Flow temperature total (VFg)
	Tendency of flow temperature
	Return flow temperature total (RüFg)
	Binary inputs (activated binary inputs are marked by a square) ✳ Press enter key. Display: Binary outputs (activated binary outputs are marked by a square)
	Boiler 1 or 2 as lead boiler

Display	Parameter designation
	Lockout time/lag delay
	Time interval for lag/lead sequence change
	Average capacity of the last three days in kW Press to enter key. Average capacity of the current day in kW
	Time Press to enter key. Display: Times-of-use for Monday (1) to Sunday (7)
	Vacations Press to enter key. Display: Dates when vacation starts and ends

Display	Parameter designation
	Public holidays Press to enter key. Display: Dates of programmed public holidays

Info level 8 (*InF8*)

Display	Parameter designation
	Error status register FSr 1 Press to enter key. Display: FSr 2
	Sensor failure The affected sensors are marked by a square under the corresponding number. 0 (VFg) · 1 (Stgk2) · 2 (Stgk1) · 3 (KF2) · 4 (KF1) · 5 (RüF2) 6 (RüF1) · 7 (RüFges) · 8 (AF) · 9 (SF1) · 10 (SF2) · 11 (RF1) 12 (VF2) · 13 (RüF Hk2) · 14 (RLG1)

Info level 9 (InF9)
(only with Co9 -> Fb01 = ON, Co9 -> Fb06 = ON or Co9 -> Fb10 = ON)

In the main display loop, the connection status appears in the InF9 level and only exists when the modem, SMS or fax function is active, otherwise just "END" appears on the display.
In this display, the applicable status from the following list of states appears when a modem connection is established.

"PAUSE": Device start (not yet initialized), dialing interval
"INIT": Modem has been initialized
"FREE": No connection established, modem is ready
"RING": Modem has been dialed, connection has not yet been established
"CALL": Modem is dialing the control station
"CONN": Connection to control station is established
"ENDE": Disconnection taking place

With "Fax function" setting, GENG3, 00, 40, 60, 80 appear on the display in sequence as the connection is being established.

13.4 Sensor resistance tables

Resistance values with PTC resistors

Type 5224 Outdoor Temperature Sensors, Type 5264 and Type 5265 Return Flow Temperature Sensors, Type 5264 Storage Tank Temperature Sensors

°C	–20	–10	0	10	20	25	30	40	50	60	70	80	90	100	110	120
Ω	694	757	825	896	971	1010	1050	1132	1219	1309	1402	1500	1601	1706	1815	1925

Type 5244 Room Sensor

°C	10	15	20	25	30
Ω	679	699	720	741	762

Resistance values with Pt 1000 resistors

- Outdoor temperature sensor: Type 5227-2
- Flow and return flow temperature sensors and storage tank temperature sensor: Type 5277-2 (thermowell required) and Type 5267-2 (contact sensor)
- Room temperature sensor: Type 5257-1 and Type 5257-5 (room panel)

°C	–35	–30	–25	–20	–15	–10	–5	0	5	10
Ω	862.5	882.2	901.9	921.6	941.2	960.9	980.4	1000.0	1019.5	1039.0

°C	15	20	25	30	35	40	45	50	55	60
Ω	1058.5	1077.9	1097.3	1116.7	1136.1	1155.4	1174.7	1194.0	1213.2	1232.4

°C	65	70	75	80	85	90	95	100	105	110
Ω	1251.6	1270.7	1289.8	1308.9	1328.0	1347.0	1366.0	1385.0	1403.9	1422.9

°C	115	120	125	130	135	140	145	150
Ω	1441.7	1460.6	1479.4	1498.2	1517.0	1535.8	1554.5	1573.1

13.5 Technical data

Inputs	
Sensor inputs and binary inputs	Max. 17 configurable inputs for sensors (Pt 100, Pt 1000, Ni 200, Ni 1000, PTC, NTC or 0-20 mA, 4-20 mA) or binary alarms
Other inputs	2 analog inputs 0-10 V, R_i = 18 kΩ
Outputs	
Control signal y	Three-step signals: Load 250 V~, 2 AC On-off signals: Load 250 V~, 2 AC Continuous control signal: 0 to 10 V, permissible load > 4.7 kΩ
Binary outputs	6 outputs to control pumps and valves, load max. 250 V~, 2 AC 2 outputs for alarms, load max. 50 V~, 100 mA
Interfaces	Serial RS-232 interface for connection of a modem; interface for meter bus
Operating voltage	230 V, 48 to 62 Hz, output 8 VA
Ambient temperature	Permissible: 0 to 40 °C · Storage: –20 to 60 °C
Degree of protection	IP 40 according to IEC 529
Class of protection	II according to VDE 0106
Degree of contamination	2 according to VDE 0110
Overvoltage category	II according to VDE 0110
Humidity rating	F according to VDE 40040
Noise immunity	According to EN 61000-6-1
Noise emission	According to EN 61000-6-3
Weight	Approx. 0.6 kg

13.6 Customer data

Station	
Operator	
Relevant SAMSON office	
System code number	

Function block settings in the configuration levels

	Co1	Co2	Co3	Co4	Co5	Co6	Co8	Co9
Fb00								
Fb01								
Fb02								
Fb03								
Fb04								
Fb05								
Fb06								
Fb07								
Fb08								
Fb09								
Fb10								
Fb11								
Fb12								
Fb13								
Fb14								
Fb15								
Fb16								
Fb17								
Fb18								
Fb19								
Fb20								
Fb21								
Fb22								
Fb23								

PA1: Boiler 1 (systems Anl 1 to 7)

PA2: Boiler 2 (systems Anl 4 to 7)

Parameters	*PA1*	*PA2*	Range of values
Maximum flow temperature			20 to 160 °C
Minimum return flow temperature			20 to 120 °C
Minimum activation time			0 to 90 min
Minimum deactivation time			0 to 90 min
Function block parameters (Co1/Co2):			
Start-up time for boiler (Fb01 = OFF)			0 to 5400 s
K_P (proportional gain) (Fb05 = ON/OFF)			0.1 to 99.9
T_N (reset time) (Fb05 = ON/OFF)			0 to 999 s
T_V (derivative-action time) (Fb05 = ON/OFF)			0 to 999 s
K_P (proportional gain) (Fb06 = ON)			0.1 to 99.9
T_N (reset time) (Fb06 = ON)			0 to 999 s
T_V (derivative-action time) (Fb06 = ON)			0 to 999 s
T_Y (valve transit time) (Fb06 = ON)			5 to 240 s
Hysteresis (Fb06 = OFF)			0 to 30 °C
Min. activation time (Fb06 = OFF)			0 to 600 s
Min. deactivation time (Fb06 = OFF)			0 to 600 s
K_P (proportional gain) (Fb07 = OFF)			0.1 to 99.9
T_N (reset time) (Fb07 = OFF)			0 to 999 s
Start (lower value) (Fb07 = ON)			0 to 1000
Stop (upper value) (Fb07 = ON)			0 to 1000
T_V (derivative-action time) (Fb07 = OFF)			0 to 999 s
T_Y (modulation transit time) (Fb07 = OFF)			5 to 240 s

PA2: Separate heating circuit (only systems Anl 1 to 3 with Co5 -> Fb13 = ON)

PA3: Direct heating circuit (only systems Anl 1 to 3 with Co5 -> Fb13 = ON)

Parameters	*PA2*	*PA3*	Range of values
Outdoor temperature, point 1			–20 to 50 °C
Outdoor temperature, point 2			–20 to 50 °C
Outdoor temperature, point 3			–20 to 50 °C
Outdoor temperature, point 4			–20 to 50 °C
Flow temperature, point 1			20 to 160 °C
Flow temperature, point 2			20 to 160 °C
Flow temperature, point 3			20 to 160 °C
Flow temperature, point 4			20 to 160 °C
Set-back difference, point 2			0 to 30 °C
Set-back difference, point 3			0 to 30 °C
Gradient, flow			0.4 to 3.2
Level, flow			–30 to 30 °C
Set-back difference			0 to 30 °C
Flow temperature set point			20 to 160 °C
Maximum flow temperature			20 to 160 °C
Minimum flow temperature			20 to 120 °C
Day set point (room set point)	–		10 to 40 °C
Night set point (reduced room set point)	–		10 to 40 °C
Sustained temperature	–		10 to 40 °C
OT deactivation value in reduced op.			–10 to 50 °C
OT deactivation value in rated oper.			0 to 50 °C

Function block parameters	*PA2*	*PA3*	
Advance heating time (Fb05 = ON)	–		0 to 360 min
START summer mode (Fb11 = ON)			01.01 to 31.12
STOP summer mode (Fb11 = ON)			01.01 to 31.12
Outdoor temperature limit (Fb11 = ON)			0 to 40 °C
K_P (proportional gain) (Fb14 = ON)		–	0.1 to 99.9
T_N (reset time) (Fb14 = ON)		–	0 to 999 s
T_V (derivative-action time) (Fb14 = ON)		–	0 to 999 s
K_P (proportional gain) (Fb15 = ON)		–	0.1 to 99.9
T_N (reset time) (Fb15 = ON)		–	0 to 999 s
T_V (derivative-action time) (Fb15 = ON)		–	0 to 999 s
T_Y (valve transit time) (Fb15 = ON)		–	5 to 240 s

Times-of-use, vacations and public holidays (only systems Anl 1 to 3 with Co5 -> Fb13 = ON)

	PA2		*PA3*	
	Start – Stop (1)	**Start – Stop (2)**	**Start – Stop (1)**	**Start – Stop (2)**
Monday (1)				
Tuesday (2)				
Wednesday (3)				
Thursday (4)				
Friday (5)				
Saturday (6)				
Sunday (7)				

Vacations PA2					
Start – Stop					
Vacations PA3					
Start – Stop					

Public holidays PA2 Date										
Public holidays PA3 Date										

PA4: DHW heating

Parameters		**Range of values**
Boiler set point for DHW demand		20 to 120 °C
DHW demand ON		20 to 90 °C
DHW demand OFF		20 to 90 °C
Hysteresis		0 to 30 °C
Function block parameters Co4		
Maximum limit for DHW forced charging (Fb02 = ON)		0 to 120 °C
Day of week (Fb08 = ON)		0, 1 to 7, 1–7
Disinfection temperature (Fb08 = ON)		50 to 80 °C
Start time (Fb08 = ON)		0:00 to 23:59
Stop time (Fb08 = ON)		0:00 to 23:59

Times-of-day (only systems Anl 1 to 3 with Co5 -> Fb13 = ON)

Times-of-day	Start – Stop (1)	Start – Stop (2)
Monday (1)		
Tuesday (2)		
Wednesday (3)		
Thursday (4)		
Friday (5)		
Saturday (6)		
Sunday (7)		

Parameters in *PA5* level

Parameters		Range of values
Outdoor temperature, point 1		–20 to 50 °C
Outdoor temperature, point 2		–20 to 50 °C
Outdoor temperature, point 3		–20 to 50 °C
Outdoor temperature, point 4		–20 to 50 °C
Flow temperature, point 1		20 to 160 °C
Flow temperature, point 2		20 to 160 °C
Flow temperature, point 3		20 to 160 °C
Flow temperature, point 4		20 to 160 °C
Set-back difference, point 2		0 to 30 °C
Set-back difference, point 3		0 to 30 °C
Gradient, flow		0.4 to 3.2
Level, flow		–30 to 30 °C
Set-back difference		0 to 30 °C
Flow temperature set point		20 to 160 °C
Hysteresis		1 to 20 °C
Tolerance time		0 to 99 min
Temperature t_A for releasing sequence		–40 to 50 °C
Lockout time		0 to 99 min
Lag delay		0 to 90 min
Outdoor temperature limit for lag/lead sequence change		–40 to 50 °C
Time interval for lag/lead sequence change		0 to 999 h
Outdoor temp. limit causing change to summer mode in rated operation		0 to 50 °C
Flow temperature set point		20 to 160 °C
Temperature boost		0 to 30 °C
Outdoor temp. limit causing change to summer mode in red. operation		–10 to 50 °C

Function block parameters Co5		
Frost protection limit (Fb00 = ON)		–30 to 20 °C
Delay (Fb01 = ON)		1 to 6 °C/h
Intended temperature difference (Fb02 = ON)		0 to 90 °C
Kp factor for differential temperature control (Fb02 = ON)		0 to 1.0
Start summer mode (Fb06)		01.01 to 31.12
End summer mode (Fb06)		01.01 to 31.12
Outdoor temperature limit (Fb06 = ON)		0 to 40 °C
Pump lag time (Fb14 = ON)		0 to 90 min
Boiler flow limit (Fb14 = ON)		20 to 120 °C
Boost (Fb15 = ON)		0 to 30 °C

Times-of-use, vacations and public holidays

Times-of-day	Start – Stop (1)	Start – Stop (2)
Monday (1)		
Tuesday (2)		
Wednesday (3)		
Thursday (4)		
Friday (5)		
Saturday (6)		
Sunday (7)		

Vacations						
Start – Stop						

Public holidays										
Date										

PA9: Modbus and meter bus communication

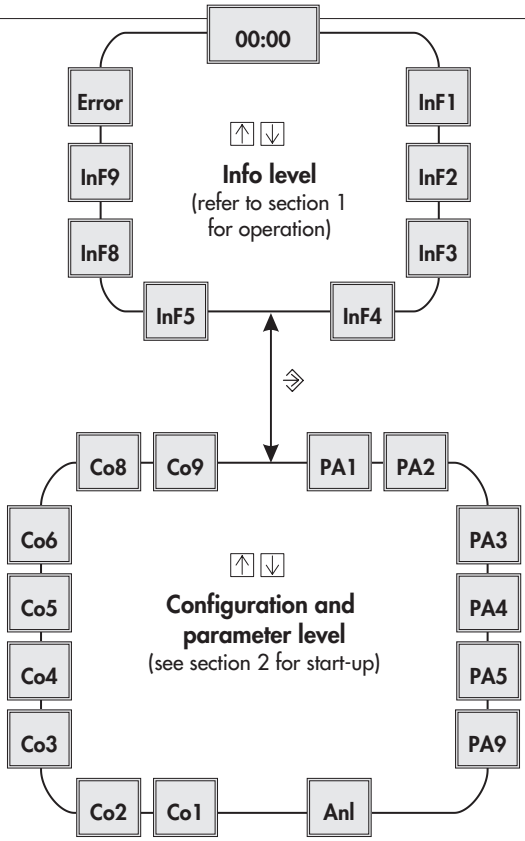
Parameters				Range of values
Station address (ST.-NR)				1 to 247
Baud rate (BAUD)				300 to 19200
Cyclic initialization (I)				0 to 255 min
Modem dial interval between calls (P)				1 to 255 min
Modem timeout (t)				1 to 255 min
Number of redial attempts (c)				0 to 99
Phone number of control station (tElno)				––
Phone number of alternative recipient (rESno)				–
Access number (taPnr)				–
Mobile phone number (Handy)				–
Function block parameters	WMZ1	WMZ2	WMZ3	
Meter bus address				0 to 255
Model code				P15, PS2, 1434, CAL3, APAtO, SLS
Reading mode				24h, con, CoiL

Index

Key number 1732

Frequently used abbreviations

AA	Analog output
AE	Analog input
AF	OUtdoor sensor
Anl	System code number
BA	Binary output
BE	Binary input
BM_	Operational alarm
Co	Configuration level
Fb	Function block
FG	Potentiometer
Frg_	Release
FSR	Error status register
GLT	Building control station
GW	Limit
HK	Heating circuit
InF	Information level
K	Boiler
KF	Boiler sensor
KW	Cold water
MBUS	Meter bus
PA	Parameter level
Pu	Boiler pump
RF	Room sensor
RK	Control circuit
RL	Return flow
RüF	Return flow sensor
SF	Storage tank sensor
SG_K	Potentiometer
SLP	Storage tank charging pump
SM_	Fault alarm
St	Step of total capacity
TW	DHW heating
VF	Flow sensor
VL	Flow
WE	Default seting
WMZ	Heat meter
WW	Hot water
WWA	DHW demand
WWZ	DHW forced charging
ZP	Circulation pump



00:00	Time
InF1	Boiler 1
InF2	Boiler 2 or separate heating circuit*
InF3	Direct heating circuit*
InF4	DHW heating
InF5	General information
InF8	Error initialization
InF9	Modbus/meter bus communication
Error	Error alarm

PA1	Boiler 1
PA2	Boiler 2 or separater heating circuit*
PA3	Direct heating circuit*
PA4	DHW heating
PA5	System-wide parameters
PA9	Interface operation

Anl	System code number
Co1	Boiler 1
Co2	Boiler 2 or separate heating circuit*
Co3	Direct heating circuit*
Co4	DHW heating
Co5	System-wide functions
Co6	Sensor initialization
Co8	Error status register
Co9	Modbus/meter bus communication

* Systems Anl 1 to 3 with Co5 -> Fb13 = ON

Fig. 10 · Level structure of TROVIS 5474

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EB 5474 EN 2007-02